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SUPERIOR ACHIEVEMENT

Dr. Paul S. Galtsoff of the Fish and Wildlife Service has been a supporter and friend of the Gulf and Caribbean Fisheries Institute since its inception. In 1949, at the Second Annual Meeting of the Institute, it was proposed that a summary be prepared of the existing knowledge concerning the Gulf of Mexico, and Dr. Galtsoff was given the responsibility of editing this work. The result was the volume "Gulf of Mexico, its Origin, Waters and Marine Life," which was published in 1954 as Fishery Bulletin 89 of the Fish and Wildlife Service. The worth of this useful work, compiled by many scientists who are specialists in their various fields, was acknowledged by the "Awards for Superior Achievement" given to Dr. Galtsoff by the U. S. Department of the Interior for his fine editing job.

We are pleased to honor Dr. Galtsoff for this accomplishment and to print here his thoughtful closing statement as Discussion Leader of the Biological Session.

Guiding Principles For Biologists

PAUL GALTSOFF

The problems of southern fisheries cover a very large field. We have been talking here about sharks and how to repell them; about tunas and how they move; we talked about the growth rate of several fishes; about the biology and ecology of shrimp and how to manage them. It probably became very clear to you that large gaps in our knowledge prevent the biologist from giving a straight forward statement of what should be done to manage our fisheries.

Realizing the inadequacy of his knowledge the biologist says that more information is needed. Here he comes into conflict with the administrator, who says "All right, more knowledge is needed, but I have to have an answer *now*. I cannot withdraw into this negative attitude and say that we will wait for more knowledge, I have to do something."

Action is required, and so we come to the question, considering the complexity of life in the sea and the even greater complexity of life in organized society, of how to progress, not with the complete truth but only with a partial truth. It is an aim of our times to attain this goal of complete truth, but we may have to be content with less. The biologist is far behind the physicist and chemist in attaining the ultimate truth. When somebody asks the physicist "What is the weight of the kilogram; what is the length of the meter," the answer is prompt and definite. It is always an exact answer, with the accuracy that is desired. Our problem as biologists is to attain a similar degree of accuracy. But the farther our science advances the more complex life is revealed to be. What is simple to the untrained person is highly complex to the trained scientific mind. But against this, we have to remember that we have somehow to adjust ourselves to the reality of life, to the requirements which the social order puts upon us. We cannot withdraw into ivory towers and say that we will wait for some distant time where the complete truth is known and the correct answer can be given. We cannot do it because this time will never come and because more facts come to light which will force us to revise our ideas.

After all, what is the truth? This has not been answered in several thousand years. We are forced to the conclusion that we have to balance our programs and adjust practical applications to the extent of our existant knowledge, even though only partially correct answers can be given.

In this regard, this wonderful atmosphere of free discussion and exchange of ideas will help us to resolve the most difficult technical problems and to adjust our limited knowledge to practical application and administration. After all, it is the human being and his welfare which is the important problem.

MONDAY—NOVEMBER 15

Welcoming Address

CARLOS G. AGUAYO

Director, del Centro de Investigaciones Pesqueras de Cuba

Dr. Gonzalo del Cristo, Vice-President-Director of the Agricultural Division of the Banco de Fomento Agrícola e Industrial de Cuba, and President of this Annual Session, has conferred upon me the high privilege of representing him and the organization he directs in extending to you all a most cordial welcome.

Once again I have the pleasure of attending one of the sessions of the Gulf and Caribbean Fisheries Institute which, in spite of its short existence, has contributed greatly to the elucidation of the intricate problems of fishing in waters of the "American Mediterranean".

The study of fishery activities is extremely difficult, for, in addition to those biological and oceanographic causes which regulate life and fluctuations in marine creatures, we must keep in mind the various human motives which are truly the reason for fisheries. "Men fish for men," has repeatedly been asserted, and so, economic, social, and international factors should be carefullly weighed in the pursuit of studies aimed toward the preservation, regulation, and increase of the fishing industry.

Because of the international character attached to the exploitation of the sea, the BANFAIC was eager to sponsor this meeting, so that a mutual understanding of common problems may, in the future, help the Cuban fishery industry attain its proper level as governed by the ecological conditions of our seas, the ability of our fishing men and the endeavors of our industrialists.

The consumption of fish in Cuba in 1952 was about 50 million pounds which, for a population of almost six million, represents scarcely more than eight pounds per capita, including imported fish. It may well be said, in comparison with the consumption of fish of other regions, that Cubans don't eat fish.

The poor development of fishing in Cuba and the general low consumption are due to various causes, including the difficulties of production, preservation and transportation, some of which have lately improved in this country and are well on the way of being remedied. The fact that fishing can be enlarged in our country is proved by the rise of the tuna industry during the past decade, and in the increase in the catch of shrimp during the last year, illustrating the productivity of the insular shelf of Cuba. This shelf had been considered of low productivity, although it is 75,000 square Km. in extent and is the largest in the West Indies.

To attain improvement in the catch and reform in fishing regulations, farsighted Cuban biologists more than forty years ago sponsored the establishment of laboratories to study marine biology and other forms of research

related to fishing. Unfortunately, however, fishery research institutions never did materialize until the authorities of the BANFAIC, understanding the urgent need of creating such institutions as a step in the expansion in the fishing industries, created the Centro Pesquero, now functioning at Playa Habana. This laboratory recently acquired a trawler for the exploration of new areas and to try out new fishing gear. This boat was named after the foremost Cuban biologist, who, for so long, had dreamed of an institution of marine science in our country: "Don Carlos de la Torre". Likewise, the Agricultural Division of the BANFAIC, to obtain data on which to base its credit policies, established a Fishery Section, among whose responsibilities was an economic-social study of fishing in Cuba, which has recently been completed. In addition, to provide, through fishing credits, for the improvement of boats and fishing gears, as well as the processing of the fish, the "Asociación de Crédito Pesquero Felipe Poey", has been created.

In order to bring to completion the objectives of stimulating a substantial increase in Cuban fish production, distribution and processing, it is necessary to carry out a scientific research, some of which, as that concerning shrimp, have already begun to yield results.

Marine animals are not always localized within the boundaries of one nation, but are rather distributed outside the so-called jurisdictional waters. For this reason, their study should have the cooperation of all those interested countries. On the other hand, since marine creatures, even those belonging to the same species, show somewhat different characteristics in various regions of their geographical distribution, experience in a particular area cannot necessarily be applied to other waters with different ecological conditions. Here, again, the coordination of international experts is indispensable. In view of all this, the BANFAIC has entertained great hopes in the results of these sessions of the Gulf and Caribbean Fisheries Institute, where business men, technicians, and biologists, representatives of private enterprises, state institutions and universities from nations having common interests in the study and development of the exploitation of these seas, have come together once more. Hopes are fixed not only on specific results from the valuable works to be discussed, but also, on the intellectual encouragement to those who devote their efforts to the social-economic improvement of their country. This annual meeting would indeed serve high purpose if we reap from it a greater and better spiritual exchange. And let us hope our unselfish collaboration and understanding, in the future, as in the past, will firmly and indelibly tie our men, institutions and countries with golden links.

OPENING ADDRESS

Science and Our Fisheries

F. G. Walton Smith

Chairman, Gulf and Caribbean Fisheries Institute
Director, The Marine Laboratory, University of Miami, Coral Gables, Florida

Speaking for the Executive Committee, and for the Institution, the individual scientists, members of the fishing industry, and administrators who, by their joint efforts have formed the Gulf and Caribbean Fisheries Institute, I have the greatest pleasure in replying to the gracious welcome accorded to us by Dr. Del Cristo, to the pleasant city of Havana, and to the Country of Cuba. It is especially apt that the Institute should have accepted the invitation of the Banco de Fomento Agricola y Industrial de Cuba to hold our meeting this year in Havana. No other part of the Gulf and Caribbean area has made such great strides in fisheries exploration and in the concomitant scientific research as the Country of Cuba during the past few years. Fisheries work has recently been greatly increased in scope as a result of the farseeing initiative of the Banco de Fomento and by the infusion of new scientific blood into commercial fisheries problems, evidenced by such names as Dr. Farfante, and Dr. Aguayo, who appear on our program this week. Our contact with these interesting developments in Cuba has been made possible during the past years by the cooperation of our old friend Dr. Luis Howell Rivero and through the opportunity we have had in Miami working with Dr. José Suarez Mr. Diaz Piferrer and officers of the Cuban Navy such as Lt. Brooks and Lt. Franco.

We look forward to the important work which will in the future come from the cooperation of the younger as well as the older Cuban scientists and with those whose interest in the commercial fishery is more practical, such as these on the program this week, Dr. Del Cristo, Sr. Garcia Méndez, Sr. Ruibal, Dr. Canet and others whom I am obliged to omit only for lack of space.

In view of this great resurgence of interest in the Cuban fisheries, it may be desirable here to review briefly the history of fishery biology and the direction in which it is headed today.

Not too many years ago the science of fisheries biology hardly existed as such. Instead there were only the efforts of marine biologists to collect and describe the species and to name them. This was followed quite naturally by the development of an interest in the life histories and feeding habits of the commercial species. So far these were the necessary steps in the evolution of sound methods of management and control and by the same process of evolution the interest in fisheries at the turn of the century had become directed towards the more dynamic aspects, the questions of fish populations and the factors which operate upon them. In fact this has, until recently, been the primary interest of those whose function is to regulate the great fisheries of the world.

The emphasis of practical management at one time involved a great fashion for establishing fish hatcheries. This was based upon the general idea that

fish populations were mainly dependant upon the production of large numbers of young, and that they could be raised in much greater numbers in hatcheries than nature could provide. Today we know that the great losses which take place in the fish population occur at later stages than the fry liberated by hatcheries.

The hatchery fashion was followed by a fashion for overemphasizing the effects of commercial fishing so that a tendency grew up for advocating heavy restrictions on fishing and on fish gear, and a great vogue for closed seasons and size restrictions.

Today, although all of these factors quite clearly affect the fish populations, we are more and more realizing that it is the human race we are trying to conserve and not the fishes. Our objective is to obtain the optimum use of our marine resources, including, of course, also the need for a sustained yield. So, the emphasis is more and more towards an overall view of the fishery, including the need to seek new populations and to solve problems of fishing gear, handling, transportation, marketing and all of the various factors which interact to make a fishery successful or not.

This brief and therefore crude and inaccurate summary of our changing viewpoints is given simply to underline the philosophy upon which the Gulf and Caribbean Fisheries Institute is based. We are a committee of the whole, in which the fishery may be viewed as it should be, as an objective in which the various biological, engineering, economic and sociological studies are merely constituent parts of integrated endeavor to extract the maximum use of salt water resources.

This attitude brings about necessarily a viewpoint which argues against the imposition of restrictions or laws of any kind whatsoever upon fishing operations, until it has been made quite clear by careful investigation that such restrictions may be beneficial. We are all aware of cases in our own special areas where certain restrictions are harmful to the industry and either have no demonstrable value to the fishery stocks or merely preserve them to die a natural but useless death, conserving them for sharks rather than for human beings.

Our philosophy then is that all aspects of research, from purely observational biology, through dynamic population studies to the problems of exploration, fishery gear, engineering and marketing must be brought into play and into a judicial focus in order to bring about wise administration.

As we begin our conference in the pleasant and hospitable surroundings of Havana, I wish once more to voice our gratitude to the people of Cuba and to the officials of the Banco de Fomento and to our fellow fishermen and scientists of this country for their gracious invitation to join them in Havana. As an especial mark of our appreciation of this hospitality and as a token of the international cooperation implicit in the organization of the Gulf and Caribbean Fisheries Institute, I am happy to announce that the entire meeting will be conducted under the Presidency of Dr. Del Cristo and that Dr. Luis Howell Rivero has consented to join our Executive Committee.

MONDAY—NOVEMBER 15

Chairman—CARLTON CRAWFORD, *President, Crawford Packing Company, Palacios, Texas.*

Voluntary Federal Standards For Fishery Products

A. W. ANDERSON

Chief, Branch of Commercial Fisheries, U. S. Fish and Wildlife Service, Washington, D. C.

The adoption and use of voluntary standards for fishery products is one of the most important steps the United States fishing industry can take to place itself in a more favorable competitive position with other food products and with imported fishery products. Many segments of the domestic fishing industry are becoming aware that they no longer can afford to deny themselves the advantages of standards as a merchandising aid, particularly when they have been so widely adopted and so effectively used by competing food products.

Many agricultural food products, which are in direct competition with fishery products, have had the benefit of voluntary Federal standards for years. Standards have been developed for scores of poultry, dairy, meat, fruit, and vegetable products. For example, for such perishable products as frozen fruits and vegetables there were 35 standards on last July 1. One of the most recent to be developed was for frozen french-fried potatoes.

And, so far as imported fishery products are concerned, the more progressive foreign countries have learned the desirability of applying standards to their exports so that the United States market receives only the best of their production.

A standards program for fishery products, similar to that developed for domestic agricultural products or for foreign fishery products, is not available at present in the United States.

Standardization, or establishing a standard, simply means setting up some measure by which the producer, processor, distributor, and consumer can judge the product involved. Grades in a standard usually are considered as the positions of the product in any scale based on certain inherent and physical characteristics. A standard covers one grade or a composite of two or more grades for one product and may include inherent and related factors such as class, condition, and wholesomeness which affect the economic value or relative desirability of the product. A standard may be considered as a yardstick by which the quality of a product is measured, but standards may cover other things than quality, such as size, packaging, and so forth.

Some agricultural standards are mandatory but most are voluntary or permissive—that is, they may be used at the option of the buyer or seller. Although most standards are voluntary, the advantages usually are so obvious that the voluntary standards come into extensive use.

The arguments for voluntary standards, based on experience in the domestic agricultural field, are many. Generally, standards are said to stabilize production and to simplify processing. They promote orderly marketing and efficient trading. And they assure the buyer and consumer that purchased products are of a certain quality, type, and condition and, usually, save money for all concerned.

Specifically, standards provide a sound basis for contracts between buyers and sellers, even at great distances. The seller can offer his product—and the buyer can purchase it, sight unseen—with a minimum of discussion, since the standards constitute a universal and legal language in all parts of the country. Disputes as to quality or other factors are readily settled by an inspection on the basis of known and accepted provisions in the standards, rather than on varying trade practices or contract provisos susceptible of several interpretations.

Settlement of claims against transportation companies, likewise, is rendered much easier when certificates of inspection at the points of origin and destination can be submitted.

Standards are established with the aid of industry which, usually, leads to ready acceptance, makes techniques and trading more uniform and, thereby, eliminates sources of costly disputes. Standards usually result in the production of more uniform products which average higher in quality. Standards usually lead toward increased acceptability by the buyer or consumer because of less confusion as to quality and contents, assurance of the type and kind of product desired, and frequent savings in cost. Standards eliminate slight variations in products and containers which lead to efficiencies in production, savings in costs, and less confusion for the ultimate distributor and consumer. Standards permit easier collection, quotation, and interpretation of production, processing, and price statistics. Standards for a fishery product would permit it to be traded on a "futures" market if that were desirable. Standards make it easier for producers to pool their output for cooperative marketing. Standards make it simpler to distribute products according to varying demands for various types in different markets. Standards help to insure that advertising programs will be backed up by products meeting the advertised claims. Finally, standards are of special importance in establishing maximum values when product loans are sought.

The arguments usually quoted in opposition to standards do not seem applicable to the domestic fishing industry. It is said that in some industries standards have a tendency to make the industry rigid and inflexible because it is difficult to sacrifice large investments in equipment when new methods are discovered. This would not seem to apply to the fishing industry because of its small size and relatively small investments in equipment and its notable independence of operation. Then there is the effect of standardization on human beings—the stifling of originality and the development of a standardized race. The standardization of fishery products has so little bearing on this possibility—in contrast to our numerous and huge standardized industries—that its possible effect in this direction can be safely disregarded.

On the other hand the opposition to the extension of standards and grade designations to the consumer level has been significant in the agricultural field. It would seem, however, that this problem could be left to the future for fishery products since standardization in the fisheries field must begin

with the producer and processor and, if it never extended beyond wholesale levels, it still would provide great benefits for all concerned, including the ultimate consumer.

To develop satisfactory voluntary Federal standards for a product may require a few weeks, a number of months, or several seasons according to the commodity. In any event, the ultimate standard incorporates the results of numerous meetings with industry representatives and the repeated review of preliminary drafts. Every effort is made to issue only a practicable and workable standard.

Although, as stated earlier, the fishing industry does not have access to a standards program, such as that available to agriculture, some mention should be made of the Federal agencies which are conducting work in this or related fields. Federal specifications, as approved by the Commissioner of the Federal Supply Service, for the use of all departments and establishments of the Federal Government in buying fishery products, represent an approach to Federal standards. Specifications exist for fresh and frozen fish, clams, crab meat, oysters and a variety of canned fishery products. They were developed and are periodically revised largely with the aid of the Fish and Wildlife Service. However, the Federal Supply Service is not in a position to develop voluntary standards or inspect fishery products, since it uses the services of specialized agencies to develop its specifications.

The Federal Trade Commission, in preventing unfair and deceptive advertising and sales practices, issues cease-and-desist orders against this form of restraint of trade. It, in effect, fixes some standards of identity by limiting the use of certain names to particular species in advertisements for products.

The Public Health Service develops and promulgates standards of sanitary practices and conducts inspection services relating to public health and sanitation. However, its primary interests are shellfish such as oysters, clams, and mussels. It appears probable that neither the Federal Trade Commission nor the Public Health Service has the authority necessary to establish a standards program for fishery products and to carry out an allied inspection service. They also lack personnel trained in these fields and a fishery research background.

The Food and Drug Administration promulgates and enforces mandatory standards for food, including fishery products, but only from the standpoint of such factors as reasonable standards of identity, fill of container, and quality, in accordance with the provisions of the Federal Food, Drug and Cosmetic Act. Under the so-called "Seafood Amendment" the Food and Drug Administration has the authority to carry out continuous inspection of raw fishery products, plant equipment and processes, and the finished product for compliance with these regulations. These continuous inspection services were used extensively by shrimp canneries some years ago and later by a few oyster canneries. Now, because of increased costs, only a few shrimp canneries utilize the inspection service.

The Food and Drug Administration inspection and standards services stop short of the development and promulgation of standards for grades and the identification, certification, and inspection of fishery products. Its regulations, in effect, represent only a minimum mandatory standard upon which voluntary standards for grades may be predicated.

When a standards program and an inspection service for fishery products

have been discussed by the fishing industry, opposition to the Food and Drug Administration as a participating agency usually has been expressed. It has been regarded primarily as a law enforcement agency, and without the advantages of having responsibility for conducting fishery research for, and supplying other technical services to, the fishing industry.

The Department of Agriculture has authority to develop and promulgate voluntary standards and to inspect fishery products. It has never exercised this authority in the usual sense, except during World War II when it set up specifications for the purchase of fishery products for the Lend Lease Administration and it inspected these products through its field agents.

For some years the Congress has specifically forbidden the use of Research and Marketing Act funds for these purposes, implying that fishery activities should be carried out in the Department of the Interior as the agency primarily responsible for research and services in this field. Because of the views of the Congress, as well as the lack of trained fisheries personnel and an extensive research background, the Department of Agriculture probably would have difficulty in establishing a standards program for fishery products. It does have a fairly widespread field inspection service, which possibly could be utilized to some advantage to identify, inspect, and certify fishery products according to standards developed, for example, by the Fish and Wildlife Service and promulgated by the Department of the Interior.

The Fish and Wildlife Service of the Department of the Interior has authority to develop voluntary federal standards for fishery products. It has scientific personnel, skilled in technological and marketing problems, who are in close touch with the fishing industry. They are well acquainted with the industry's activities and have the best knowledge of, and access, to fishery literature in this field. And they have carried out research involved in the development of standards for years. For example, the Service's earlier blue crab meat studies now are being brought up to date to assist the National Fisheries Institute's work with the Atlantic Coast producers of blue crab meat.

Other technological work in the federal standards field includes research on haddock in connection with freezing-fish-at-sea studies at the Boston technological laboratory. In addition, similar research is being conducted on rockfish at the Seattle technological laboratory. The Service's work on federal specifications for fishery products has been mentioned earlier. The development of standards for canned Maine sardines has been a cooperative project with the industry's association since early this year and is making very good progress. Another cooperative project with industry is the development of standards for fillet blocks and fish sticks with the National Fisheries Institute's Committee on Fish Sticks.

An allotment of Public Law 466, 83rd Congress, (Saltonstall-Kennedy) funds has already been made to establish an industry liaison for Federal-Industry joint development and application of voluntary federal standards. And it is expected that a second allotment will be made for expanding this voluntary standards research to develop the basic data required to develop the tests which will make the standards function most effectively.

The need for voluntary standards for fishery products and an accompanying inspection service has become more acute in the last year, and industry requests for assistance in this matter have become more pressing. The more obvious reasons probably have to do with the following:

1. It has become apparent to those buyers who handle both fishery and agricultural products, that the standards and inspection service available for agricultural products have made marketing easier and encourage a better and more uniform product, which is easier to sell.

2. Most imported fishery products are subject to foreign standards and inspection which has made them, in many instances, more readily salable items than the competing domestic products.

3. Breaded shrimp, a new and most promising development, varied so widely as a product, that its market potential could not be fully realized and might even have been endangered.

4. The blue crab meat industry on the Atlantic Coast was confronted with marketing regulations, which required an assessment of current production practices.

5. Packers of canned Maine sardines, seeking to improve their products and increase and stabilize their markets, concluded that the establishment of standards was a first step.

6. Gulf and Mexican shrimp producers likewise concluded that the development of, and adherence to, standards was a necessary adjunct of a progressive shrimp industry.

7. The results of the "cuttings" of various fishery products at the annual conventions of the National Fisheries Institute demonstrated conclusively that product improvement and standardization were obvious needs.

8. And finally, Public Law 466, 83rd Congress, popularly referred to as the Saltonstall-Kennedy Bill, provides funds "to promote the free flow of domestically produced fishery products in commerce" and "to develop and increase markets for fishery products of domestic origin." Voluntary federal standards, by definition and by application, provide a way to achieve both these objectives by means of more orderly and more efficient buying and selling.

Before a voluntary federal standards program for fishery products can become available to the domestic fishing industry, three steps must be taken.

First, a set of voluntary standards must be developed with the aid of those in the industry who produce, process, and market the product in question. The Fish and Wildlife Service is already conducting research in this particular field and working with the segments of the industry interested in canned Maine sardines, blue crab meat and fish sticks and fish blocks.

Second, the standards developed must be promulgated in the Federal Register to make them of record, so that they will have legal sanction. The Fish and Wildlife Service has not yet had occasion to request the Department of the Interior to promulgate standards for fishery products, and a final decision on the Department's authority in this regard is not a matter of official record.

And third, after standards have been established and promulgated they can serve their objectives only if there is available to both buyers and sellers an inspection service in all important producing and marketing centers. The service must be capable of responding promptly to requests to examine the product in question to determine if it corresponds in quality, type, condition, class, etc., to the standards specified. Such an inspection service is usually made available to the person requesting it at a rate which represents, as nearly as may be, the actual cost to the Government.

Although the Fish and Wildlife Service has not had occasion to request the Department of the Interior to consider establishment of such an inspection service, it would appear that legislation would be required to provide it the necessary authority. As a possible or preliminary alternative it would appear desirable to investigate the inspection services in the Department of Agriculture to determine whether it would be feasible to train the inspectors in its field offices to inspect fishery products in accordance with standards established by the Fish and Wildlife Service.

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Standards Voluntarios del Gobierno para Productos Pesqueros

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Abstracto

Los productos alimenticios agrícolas que están en competencia directa con los productos pesqueros, han sido beneficiados por los standards voluntarios federales por varios años. No existen standards similares para la industria pesquera. Un standard es simplemente una medida de calidad establecida y otras características por las cuales el procesador, el distribuidor y el consumidor pueden juzgar el producto menciónado. Un grado es la posición del producto en la escala establecida por el standard. Los standards voluntarios pueden ser usados a discreción.

Standards voluntarios en los campos agrícolas se han comprobado ser estabilisadores de la producción; simplifican el proceso y ahorran dinero en todo sentido. Se argumenta contra los standards el que tiene una tendencia a hacer una industria rígida e inflexible porque se dificulta sacrificar grandes inversiones cuando se descubren nuevos métodos. Estos argumentos no parecen ser aplicables a los standards voluntarios para productos pesqueros. Antes de que los standards voluntarios federales puedan ser usados en la industria pesquera, se debea de tomar tres medidas necesarias. En primer lugar standards voluntarios aceptables deben ser desarrollados con la ayuda de la industria. Segundo, los standards desarrollados deben ser promulgados en el registro federal para darles sanción legal. Y tercero, debe de haber una

provisión para la inspección y certificación de productos pesqueros en las ciudades de grandes centros productores y grandes mercados, de acuerdo con los standards promulgados.

Diferentes departmentos del Ministerio del Interior y Agricultura se encuentran ya trabajando en pasos preliminares.

Voluntary Industry Standards for Fishery Products

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The question of standards for fishery products has developed much discussion, if not controversy, for many years. The lack of adequate standards has, no doubt, been responsible for many of the unethical practices existing in the industry today. In addition, the lack of uniform standards and a comprehensive program of quality development and control has resulted, in many cases, in the distribution of inferior fishery products to the consuming public.

Like any other industry, the fisheries must progress in order to survive. Some segments of the industry have been progressive, others have not. New production methods and techniques and some new products have been developed, but we must also develop standards—standards of quality and standards of sanitation.

About four years ago, while the breaded shrimp industry was in its infancy, it was discovered that many packers were producing a product containing more breading than shrimp. Subsequent developments, particularly discussions with the Food and Drug Administration, convinced us that something had to be done by industry. Otherwise the Government would act, and perhaps in a manner not to the industry's liking. As a result we were authorized to conduct a laboratory test of frozen breaded shrimp. Samples were purchased in the open market at the retail level by Fish and Wildlife Service personnel, tests were made at the Massachusetts Institute of Technology, and the report of the laboratory's findings was made at a special meeting during the National Fisheries Institute's Convention at Boston in 1951. I quote a short summary of M.I.T.'s report: "The proportion of breading on commercial breaded shrimp samples varied between 21.9 and 62.3 per cent and averaged 41.0 per cent. In the case of 18 of the 26 samples, the breading was in excess of 35 per cent. The ammonia content of 12 of the 26 breaded shrimp samples was sufficiently high to indicate that the quality was questionable or bad. Ammonia content appeared not to be correlated with bacterial count but 11 of the 12 samples which were high in ammonia were among the 12 samples of lowest quality as determined by organoleptic tests. As a matter of fact, in seven of the 26 samples, the breading content was 50 per cent or over.

Subsequent tests have indicated little or no general improvement in bacteria count, while the average percentage of breading has gradually gone up, so that the 1954 tests showed an average of 48.8 per cent breading. Ten

of these samples contained 50 per cent or over of breading. Our Quality Committee discussed breading standards during the 1953 N.F.I. Convention in Washington, D. C. At that time a two-day meeting was held, and it was estimated that about 75 per cent of the volume of breaded shrimp produced was represented. Six months later "Suggested Tentative Standards for the Breaded Shrimp Industry" were set up and approved, and subsequently subscribed to by additional packers. This marked the first attempt by industry to set up standards.

In 1952, N.F.I. conducted a frozen fish and shellfish, and a canned fish cutting and judging at the Los Angeles Convention. Here again the results were generally poor. During the following year, 1953, frozen cod, haddock and ocean perch fillets, headless shrimp, and canned sardines were included. In 1954 the program was expanded to include flounder, sole and Pacific perch fillets, halibut and salmon steaks and fish sticks. Results of the second (1953) cutting and judging showed that a great improvement had been made in quality over the samples judged at Los Angeles. The 1954 tests showed that one item held about even with 1953, while the balance showed a slight decline and in one case, a marked decline. A vast amount of work remains to be done on improving the quality of packaged frozen fishery products.

Despite the great strides made in production and distribution techniques in frozen fish and shellfish, little or no advances have been made in the development of better quality fresh fish. At our recent convention in Cleveland, Ohio, it was brought out that there is still available a great market for fresh fish and shellfish. We certainly hope that, through our newly created Fresh Fish Committee, we can provide the necessary revitalization for this still very important segment of our industry.

Within the past two years investigations by government agencies, including the New York City Department of Health, have shown that deplorable sanitary conditions existed in some processing plants in the blue crab industry. N.F.I. has, within the past year, called many meetings of producers in an endeavor to bring about better sanitary conditions in processing plants as well as in the distribution of picked crabmeat. Through our Blue Crabmeat Committee, and with the help of Government technologists, a "Voluntary Sanitation Code" has been drawn up. This code, while not approved by Federal, State or City Governments, is, nevertheless, a step in the right direction, and is being subscribed to by the industry.

You are all familiar with fish sticks, the production and distribution of which has mushroomed during the past two years. In producing fish sticks it is first necessary to fillet and skin the fish and then press and freeze the fillets into blocks or slabs before cutting or sawing into sticks. Again at our Cleveland Convention the fish stick industry met in an endeavor to work out some of the most pressing problems then confronting this fast growing segment of the industry. It was agreed that specifications or standards had to be drawn up, so that this new and revolutionary development could get off on the right foot. First, it was necessary to develop block or slab specifications. This phase of the work has been underway since shortly after the convention and is now completed and ready for adoption. The next phase will be the development of standards for fish sticks, both cooked and uncooked, including the breading and/or batter and oil used

for frying. All of the foregoing leads to the one ultimate aim of N.F.I.'s Quality Program—the placing before the general public of wholesome and nutritious fish and shellfish products of the highest possible quality. No matter how much money is spent to promote a commodity or advertise a product if it does not meet a high quality standard—time, money and effort have been wasted.

Among other advantages, standards will provide a practical means of determining loan and sale values, through the medium of proper inspection and the issuance of appropriate certificates which will bind both seller and buyer to accept the verdict of the issuing party, whether the latter be a government agency or a private laboratory. It must be agreed beforehand that, since these industry standards are voluntary, both buyer and seller will agree to bind themselves by any decision handed down in the certificate of inspection.

For many years, problems of quality and quality development in all segments of our industry have been handled by N.F.I.'s Quality Committee. This placed an almost insurmountable burden on this committee, particularly the chairman. During the past year the work load has been spread by the appointment of commodity sub-committees, such as Breaded Shrimp, Fresh Fish, Blue Crabmeat and Fish Stick Committees. No doubt there will be need for other committees as time goes on. This will have the effect of better control of the over-all quality program.

With Saltonstall-Kennedy funds now available to the Fish and Wildlife Service, it will be possible for the federal government to collaborate with industry in developing and establishing voluntary standards. A long term educational program will be necessary. It will affect everyone from the fishermen on up to the retailer and the entire process must be kept on a high quality plane. Voluntary industry standards are bound to bring about many benefits. Not only will packers and processors of similar products be brought closer together, but they will also bring about economies in the industry. In affording security in selling and buying commitments, they will bring about better relations and understanding from the fisherman on down to the retailer. Voluntary industry standards will benefit the consumer and industry alike by giving the consumer better quality products and better industry public relations.

Standards Voluntarios Industriales para Productos Pesqueros

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Abstracto

La industria pesquera debe progresar no solo en el desarrollo de métodos y productos nuevos, sino también en el desarrollo de standards de calidad. Por los dos años pasados el National Fisheries Institute ha trabajado en el desarrollo de un standard para camarones empanizados, que se convirtió en un Standard Voluntario Industrial aceptado por varias firmas que producen 75% del total de esta industria.

Investigaciones que se condujeron por varias agencias gubernamentales, demostraron que condiciones sanitarias abominables existían en algunas plantas en la industria de la carne de cangrejos azules. El National Fisheries Institute ha tratado de establecer standards sanitarios entre los varios productores.

En la convención del National Fisheries Institute en 1954 se discutieron y se trataron de establecer standards voluntarios para las croquetas de pescado. Este trabajo ha sido hecho en estos últimas meses y está ahora casi completo.

Standards for Crab Meat

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The summer of 1953 was like the lull before the storm, with the crab meat industry prospering. By August there were a few scattered reports of food poisoning due to crabmeat, then all of a sudden more food poisoning cases were reported. The public was alarmed, particularly in the New York, Baltimore and Philadelphia markets. The papers in New York City demanded that the Health Department take steps to prevent the "wanton poisoning" of their readers. The New York City Health Department then asked the Federal Food and Drug Administration for help.

A crew of federal inspectors and technicians in a mobile laboratory came upon the scene to locate the source of the trouble. These men tried to be of assistance and make suggestions for the benefit of the operator. A second contingent of federal inspectors, which the industry referred to as the "wrecking crew", now arrived on the scene. Its job was to make plant inspections and sample interstate shipments. Within short order many shipments of crabmeat were embargoed, some later released, others seized and condemned.

The effect of this upon crabmeat sales was disastrous. There was no ready market; the commission merchants were wary about buying and the consuming public was afraid to eat fresh crabmeat. The Federal Veterans Hospital Administration stopped buying crabmeat and New York City was ready to ban shipments to that city. Other major cities were preparing to do likewise.

The crabmeat industry was in serious difficulties, and at this crucial time the National Fisheries Institute entered the picture. It headed off any immediate drastic measures that had seemed certain to be taken by New York City. It promised the officials that the industry, itself, would at once do something.

In order to carry out the promise that N.F.I. had made, Mr. Jackson, its General Manager, initiated area meetings of crabmeat producers along the Atlantic seaboard, at which the dealers were forcefully told that the salvation of their markets was in their own hands. Some packers readily admitted that at times their plant sanitation had slipped, but all expressed willingness

to remedy the situation. The Blue Crab Committee was organized and met at National Fisheries Institute headquarters in January, 1954, to formulate a sanitary code for the crabmeat industry. Codes from the various states were compared and that of Virginia was used as a basis for the National Fisheries Institute code. Some additions were made in order to strengthen this voluntary industry code.

The foreword of the Code reads as follows: "The objective sought through the adoption of these Voluntary Industry Rules and Regulations are:

1. To safeguard the health of persons eating crab meat.
2. To assure uniform inspection of procedures and sanitation standards among the subscribers to this code.
3. To provide for an accredited list of crab meat packers subscribing to this voluntary industry code.
4. To provide operators of cooked crab establishments and crab meat plants with an adequate, practicable guide for the construction, equipment, maintenance and operation of their establishments."

The Code establishes standards for the various structural aspects of the plant: picking operations, cleaning and sterilizing of equipment, and all other matters directly and indirectly concerned with crab meat production.

Then the Code discusses accreditation. This refers to the fact that, after all plants have had an opportunity to review the Code and subscribe to it, N. F. I. will submit to all regulatory agencies, in all areas where fresh crabmeat is marketed, an approved list of plants. It should be mentioned that such accredited list is not limited to N. F. I. members alone, since any plant has the privilege of being on such list, provided it can meet the provisions of the code and conscientiously abide by them.

The question then arose as to who would decide whether a plant can qualify for accreditation. It was decided by the N. F. I. Technical Committee that the local health officer, where possible, will make the first qualifying inspection. In areas where this is not possible, a qualified commercial laboratory (approved and designated by the N. F. I. Technical Committee) will do the certifying. Furthermore, a plant wishing certification may select a laboratory, provided that the laboratory is qualified in the opinion of the N. F. I. Technical Committee. The process of accreditation is thus on an impartial basis, and all plants are given an equal opportunity to qualify before the accredited list is published.

Despite the fact that New York City looks upon this Voluntary Industry Code with favor, its attitude is conservative. The New York people maintain that no quality control program is better than the follow-up. During the time the Voluntary Industry Code was being drafted, New York City had been testing samples of crabmeat. The Health Department sent its reports, some favorable, others not, to the various plants. These reports expressed the results of the testing in terms that were unfamiliar to some packers. Heretofore, any bacteriological reports that they had received had been sent by the Federal Food and Drug Administration. If the crabmeat they sampled showed the presence of *E. coli* of fecal origin, the plant was so notified. If *E. coli* was not present, there was no notification. Therefore, it seemed to the packers that New York City was trying to impose standards and regulations foreign to the crabmeat industry.

N. F. I. arranged a meeting with the Director of the Food and Drug Division of the New York City Health Department in April, 1954, to discuss this new type of bacteriological testing regarding fresh crabmeat.

During the summer of 1953, all cases of food poisoning directly attributed to crabmeat were caused by hemolytic Staphylococci. These bacteria are the same kinds that may be found in pie fillings, custards, and cream puffs and are insidious due to the fact that they produce a toxin that is not destroyed by the usual cooking temperatures. Even though the bacteria themselves are dead, their toxin still exists as a potential public health hazard.

These bacteria may be found on the hands; more so if the worker has any sores or open cuts on his hands. In this way they can easily contaminate the food being packed.

Crabmeat showing an abundance of Enterococci constitutes a health hazard. These bacteria are of fecal origin and therefore are of sanitary significance in any food operation. Other bacteria involved in this testing were the coliforms including harmful types such as those producing Typhoid and Dysentery, as well as many harmful ones. If many coliforms are present in crabmeat there is a real possibility that harmful kinds may be included.

The Standard Plate Count, as used by the New York department, expresses the total number of bacteria present, making no effort to differentiate among the innumerable kinds.

The various standards that New York City planned to adopt to determine the bacteriological quality of fresh crabmeat, in the order of their importance, are as follows:

Hemolytic Staphylococci	100 per gram
Enterococci	1000 per gram
Coliform	100 per gram
Standard Plate Count	100,000 per gram

In July, 1954, the City of New York made an amendment to its Sanitary Code. This, in effect, stated that any crabmeat offered for sale in that City must be sterilized and in a hermetically sealed can, or if it is marketed as fresh crabmeat, it must comply with the bacteriological standards above.

During the late spring and throughout the summer our Laboratory was engaged in the testing of crabmeat, for Standard Plate Count. This work was carried out in the plants in northern Florida and southern Georgia, and involved nearly four hundred samples per month for several months. In reviewing these data, a question arose as to whether the plants in the Southeast can consistently produce meat that will comply with the 100,000 New York standard. The other standards were felt to be reasonable, but some doubt was felt that the 100,000 maximum Standard Plate Count might be difficult to achieve immediately. Moreover, this amendment to New York City's Sanitary Code was scheduled to go into effect January 1, 1955.

Recently at a Seafood Seminar, sponsored by the Maryland Department of Health at Solomon's Island, Maryland, it was suggested to the Shellfish Division of the New York City Department of Health that there was not sufficient information to justify this standard. We held the view that it was important to do year-round testing in representative areas along the coast in order to take into account the different climatic conditions and their effects.

Postponement of the implementation of this standard was requested. It was pointed out that when the U. S. Public Health Service decided to establish a bacteria standard for raw milk at the first the allowable maximum bacteria count was high. There was an understanding that as the milk producers improved their sanitation and production methods and showed that they could produce a milk of better bacteriological quality, this allowable maximum would be lowered. At the present time the U. S. Public Health Service has a standard of 200,000 for raw milk. Quality-minded producers are able to meet this standard, and even better it.

This analogy was used to support the idea of a flexible standard for the Standard Plate Count of crabmeat. Originally it was felt justified to set the bacteria standard at a figure higher than 100,000. If the majority of the packers employing good plant practice can consistently produce meat of better quality, then this standard could be tightened. The representative from New York City promised that his Department would consider this.

This is the first time that any definite action has been taken toward the establishing of standards for crabmeat. It is a step in the right direction. The standards serve as an incentive for further work and they embrace types of bacteria more important to the testing of quality of crabmeat than merely testing for *E. coli* alone. A positive test for *E. coli* may not be informative enough for a packer in order to correct a bad sanitary situation, whereas a report showing analyses for the bacteria named in the New York standards would be more useful, helping the packer locate the source of the contamination more easily.

The fresh crabmeat industry is to be commended for the effort that it has put forth as a result of the crisis described above. The packers have begun to raise their standards of quality by their own efforts. The bacteriology of a crabmeat operation is not too well known. It was our general belief until recently, for example, that the majority of bacterial contamination took place in the picking room. Yet, even though sanitation conditions in this section were good, the bacterial counts on the crab meat were still high in many cases, and attention then began to be paid to other parts of the operation.

Along the Atlantic Coast two different types of operation exist. North of the Carolinas the cooked, cooled crabs are given to the pickers directly, who do their own "backing", i.e., remove the back shell of the crab. After this is done, they proceed with the picking of the meat. This process is generally referred to as a "dry pick". South of the Carolinas the cooked crabs are cooled on tables in the "backing room". A crew then removes the shell back. These backed crabs are washed, usually by means of water flowing down a metal flume. These washed, backed crabs are given to a different crew that does the picking of the meat. This method is commonly known as the "wet pick".

In the backing room of a wet pick operation we ran a series of bacteriological tests. We were startled at some of the things we learned. It has been assumed that the crab is sterile, both externally and internally, immediately after removal from the cooking retort. Our testing has shown that this is not necessarily true. This raised questions as to what is the best cooking time and the temperature and pressure relationship that will insure sterility and yet not adversely affect the flavor of the meat. The uniformity of cooking for various batches of crabs and the proper cooling method also came in for

scrutiny as a result of these findings. The present method of cooling may actually be the worst way.

Another possible way to insure good quality crabmeat is to pasteurize it. Fish and Wildlife Service experiments have shown that it is possible to produce crabmeat of reasonably good quality, but in my opinion not quite like fresh crabmeat. Fresh crabmeat has a delicate flavor that is easily affected by heat. Therefore, even though laboratory tests may show that pasteurization of crabmeat will keep down the bacterial counts, I believe it is not the answer because the product is a different one from fresh crabmeat. One packer from Maryland is pasteurizing part of his meat production and others intend to do the same. It appears that some problems have yet to be solved before a product can be made comparable with the fresh.

This research, sponsored by the industry, shows that the industry is recognizing the problems confronting it and is expending an earnest effort to solve its problems. The industry is meeting its challenge and accepting its responsibility.

Standards para Carne de Cangrejo

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Abstracto

En agosto de 1953 ocurrieron varios envenenamientos a lo largo de la costa Atlántica, los cuales se reportaron ser debidos a carne de cangrejo. Como resultado el Departamento de Salubridad de New York, el Federal Food and Drug Administration y la industria pesquera guiados por el National Fisheries Institute colaboraron para producir un Código Voluntario de Calidad, basado en el código de Virginia. Al mismo tiempo la ciudad de Nueva York empezó a analizar carne de cangrejo. Después de una reunión de los distribuidores y otros varios organismos, en julio de 1954 la ciudad de Nueva York hizo un enmienda en su código sanitario, por la cual se establecía que toda la carne de cangrejo para la venta en esa ciudad debería ser esterilizada y en un lata cerrada herméticamente, y si vendida como carne fresca debe de llenar los standards bacteriológicos. Los standards establecidos por Nueva York son considerados como muy buenos, pero uno de ellos, "el recuento total de placas" debería ponerse más alto con el entendimiento de que la industria mejorará con la experiencia. El nuevo tipo de análisis es informativo para el distribuidor y si es usado propiamente ayudará a localizar las fuentes de contaminación bacteriológica en la planta.

Shrimp Industry Standards of Quality

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When a new industry is born, the people involved in its development ordinarily give little thought to its future. They do not attempt to make long range plans for development and expansion; they are concerned chiefly with the present, in a trial to see if the enterprise can be made commercially successful.

The men involved in the origin of the shrimp industry thought mainly of catch methods; the marketing of their product was purely a local matter. Shrimp caught during the day were sold the next morning, and could be purchased only in the immediate producing area.

Thus the shrimp industry remained a minute segment of our fishery until commercial canning was successful, first in 1875. The industry grew, until there were 93 canneries operating in 1924. Today, there are approximately 40. Economics was the main reason for the demise of many of the shrimp canneries, but underlying their economic failure was a complete lack of quality control.

The first steps towards quality control were introduced in the shrimp canning industry in 1934, when voluntary government inspection was initiated by the United States Food and Drug Administration. The number of plants having such inspection grew rapidly until a maximum of 48 were operating under its service.

Then, with the war years, came the diversion of shrimp from the canneries to the fresh and frozen trade. Since that time canning has seen a resurgence, but the number of canneries operating under government inspection has dwindled to nine. Many of the canners who have discontinued the service feel that because of their education while under government regulation, they can produce quality merchandise without government supervision, with its inherent high cost. To further their ends, the canners adopted Industry Grade Standards.

These grade standards, adopted at an industry-wide meeting held under the auspices of the National Shrimp Canners Association in January, 1954, set the sizes for shrimp under the following designations, these grade sizes to be based on the cut-out weight per ounce after processing.

Colossal	less than 2.5 per ounce
Jumbo	less than 3.5 per ounce
Large	3.5 to 5 per ounce
Medium	more than 5 but not more than 9 per ounce
Small	more than 9 but not more than 17 per ounce
Tiny	more than 17 per ounce

A weight tolerance of 8 per cent was adopted for the differential in loss between the regular pack and the cleaned or deveined pack. Usage of such terms as "broken", or "whole and broken", was defined. A tolerance of not more than 5 per cent of broken shrimp in a pack of whole shrimp was to be allowed.

The adoption of these standards was a forward step for the canned shrimp industry, but there is no method of enforcement save that which is exercised

by the buyers. As a consequence, we have heard rumors that in certain instances confusion exists as to size designations. This is especially true in the labeling of "tiny" as "small".

Historically, practically all shrimp produced on the Atlantic Seaboard have been shipped to market in the fresh stage, but the picture is changing. More and more of the production is being processed as frozen, or as breaded shrimp. Chemical, bacteriological and organoleptic analyses of market samples made over a period of several years by an independent laboratory show clearly that quality control standards should be set up by the breaded shrimp industry, not only on the Atlantic Seaboard but in all other areas where shrimp are breaded. Some individuals have heeded the warning of these laboratory findings, and are exercising certain methods of control, but the industry as a whole has responded little or not at all.

One segment of the fresh shrimp industry deserves commendation. The Tampa Shrimp Producers Association of Tampa, Florida, and The United Shrimp Producers Association, Inc., of Fort Myers, Florida, have been attempting to set up and enforce their own quality control program, against considerable opposition from outside their membership. These programs, conceived and promulgated by the members of the two associations without outside help, is certainly a progressive move. Four quality grades have been established, namely: "pearls", "good", "fair" and "pick-outs". Standards are based mainly on melanosis or blackening. Considerable latitude is given the inspectors of these associations, and their decisions, when questioned, are either substantiated or altered by a Quality Control Board constituted of any two members or stockholders of the corporation in good standing, other than the member whose products are being graded. Much effort has been expended by these associations to educate the fishermen in proper methods of catching, handling, and sanitation, with the result that a radical improvement in the quality of shrimp reaching port has been noted by the members. Boat crews are paid on the basis of the quality of the shrimp they produce; thus they, too, benefit from good practice and sound operation.

The frozen shrimp industry prior to 1937 was small. A few shrimp were frozen, but these were mainly the overflow from glutted fresh markets. It was not until 1942 that this branch of the industry really began to grow, together with the rest of the frozen food industry. Today, far more shrimp is handled in the frozen state than in any other form.

In August, 1951, with the formation of the Shrimp Association of the Americas, a Quality Control Committee and a Scientific Advisory Committee were appointed. For a period of time the members of the Shrimp Association of the Americas were sent information sheets describing quality control and plant sanitation procedures. While this device was useful, it was not felt to be adequate. At its Miami meeting last year, the board of directors instructed the chairman of the Quality Control Committee to draft and have ready for discussion at its Cleveland meeting in the spring, a complete set of regulations and standards for the quality control of frozen shrimp.

Tentative standards were prepared and submitted at the Cleveland meeting in April; these were revised as the result of suggestions from various members.

In July, at its regular annual meeting in Mexico City, the Shrimp Association adopted these proposed standards. At that time, the board of directors requested all members to attempt adherence to these standards on their own

initiative. The board of directors also requested the Quality Control Committee to investigate measures to implement the standards, in order that a quality seal could be developed and utilized, to show that the shrimp so marked had been produced, packed and frozen under the "Standards for Quality Control of the Shrimp Association of the Americas."

The adopted standards were prepared and drafted by the Scientific Advisory Committee after consultation with members of the Quality Control Committee. They are predicated on sound biological, bacteriological, physical and practical bases. They are not difficult to apply. When put into use, they will assure that a superior product will reach the market, one of which no producer will ever be ashamed — one which can be advertised as capable of fulfilling all demands of a gourmet, or of satisfying the most exacting requirements of food inspectors or buyers.

These standards, for working purposes, may be divided into three categories:

A. Boats and boat operations

B. General plant facilities and equipment

C. Plant operations

Under section A, specific sanitation and handling methods are outlined. Maximum trawling and exposure times are designated; proper methods of washing and icing the shrimp are specified.

Under section B, proper plant facilities are described. Buildings must be well lighted, ventilated, screened, and insect and rodent-proofed. Building designs shall be such that all equipment, which must be of metal or other non-porous material, is readily accessible for cleaning. Floors must be tight and properly drained into a closed drainage system. Water supplies must be unpolluted. Adequate sanitary facilities must be provided for all employees. Wash basins supplied with soap and a hand sanitizing agent must be so placed in the plant that they are easily observable by supervisory personnel. Devices for washing inspection belts and conveyors for shrimp must be installed. Metal containers, flumes, chutes, or conveyors are to be provided for removal of debris. Provision for proper maintenance of glaze water temperatures must be made unless shrimp are overwrapped. Recording thermometers are recommended for freezer and storage rooms.

Section C, covering plant operations, is quite detailed. All equipment in the plant and all equipment utilized in transporting shrimp shall be thoroughly washed and sanitized after each use. Shrimp shall be properly iced at all times. On delivery to the plant, the shrimp must be washed, inspected, and culled. Decomposed shrimp, which are strictly defined, shall be discarded and not further processed for human consumption. Shrimp shall be handled only on clean surfaces and in an expeditious manner in order to prevent contamination and spoilage. Grade size classifications are set up with necessary tolerances. Broken shrimp, or pieces of shrimp are defined and tolerances allowed in each grade size are specified. A standard method is promulgated for determining the thawed, drained weight of the packaged shrimp, such weight to meet the declared weight on the package. Provision is made for proper packaging, glazing, and for overwrapping. Maximum freezing times are stipulated. Sanitary personal habits must be observed by all employees.

The "Industry Standards for Quality Control" adopted by the Shrimp Association of the Americas, and the Canned Shrimp Industry, have been published.

Study of these standards should convince a qualified reader that they are sensible and workable. However, any industry standards are completely valueless unless they are implemented by industry policing and enforcement. Enforcement methods may be many and varied, and it is hoped that industry leaders will soon work out the means for practical implementation of the standards which have been adopted.

Standards de Calidad en la Industria de Camarones

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Abstracto

Plantas de enlatado de camarones fueron puestas bajo inspección voluntaria del U. S. Food and Drug Administration en 1934. En la actualidad pocas plantas se aprovechan de este servicio en la creencia de que ellos pueden producir productos de alta calidad sin necesidad de supervisión. In 1954 los enlatadores adoptaron standards de grado para el tamaño.

Análisis sobre la calidad de camarones empanizados han demostrado la necesidad por standards para este producto.

Dos Asociaciones de la Florida han instituído standards los cuales han levantado la calidad del camarón fresco producido en ese estado. La calidad se juzga mayormente sobre la mancha negra.

La Asociación Camaronera de las Américas ha adoptado standards voluntarios de calidad para camarones frescos. Estos standards cubren el manejo de los camarones en los botes pesqueros, así como la calidad de los camarones. Es necesario ahora para la industria el poner en efecto estos standards.

Voluntary Federal Grade Standards for Fish Sticks

CHARLES BUTLER

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The phenomenal success of fish sticks in the market place is well known to the fisheries industry. Within the past few years, sales have zoomed from the market test level to an estimated 50 million pounds for this current year. As further evidence of this fish stick popularity, we note that other competing protein foods are climbing aboard the band wagon. Chicken sticks and ham sticks are among the products either on the market or being readied for a sales promotion campaign. If these agricultural products follow the pattern set by that industry in the past, voluntary federal standards and inspection will be an integral part of its production and distribution system. The advantages of food products properly graded and inspected for wholesomeness and accepted as such by the consuming public are rather well established for many

agricultural commodities. You may have noted as a part of the "use more meat" drive now in progress that newspaper advertisements stress the "U. S. graded and inspected" feature for meat and poultry as an inducement to sales building.

At the National Fisheries Institute Convention in Cleveland in April, 1954, the first formal action was taken toward the stabilization of fish sticks at an acceptable quality level through the appointment of a Fish Sticks Committee. This committee includes representatives from the country as a whole. A technical sub-committee was created and instructed to prepare a suggested draft of standards. This sub-committee believes that voluntary grade standards, like those developed and applied to agricultural products by the Agriculture Marketing Service, should be developed for fish sticks.

Part of the Fish and Wildlife Service's technology research program of the past year has been to develop information on voluntary grade standards for several fishery products. Data essential to the evaluation of quality for frozen haddock fillets were accumulated during comparative study of fillets from haddock round-frozen at sea and those from iced, gutted haddock. The data were written up essentially as a voluntary federal standard of quality for use in the research work. Through this haddock study, many of the different problems in working out standards for fisheries products, as contrasted to those of agricultural products for which established standard development procedures are available, were brought out.

Our second study in this field began early last spring when the Maine Sardine Industry sponsored a cooperative project with the United States Fish and Wildlife Service to develop information looking toward voluntary grade standards for canned Maine sardines. Here again our technologists have gained valuable experience in the formulation of the quality requirements for each grade, the definitions from commercial practices of styles of packs, the preliminary field testing of inspection procedures, and the preparation of a working draft of the standard.

The Technology Section's research program, as worked out at an Industry Conference in June, 1954, includes a project to be carried on jointly at the Seattle and the Boston laboratories entitled "Fish Sticks, Storage Characteristics and Quality Standards." This work is an expansion of smaller scale studies begun in 1953 on fish sticks at each of these laboratories. Commercially prepared fish sticks have been purchased for examination and evaluation of their characteristics. Experimental lots of fish sticks are prepared by our staff to supply samples of known history. Among the variables now under study are the effect on the final product of:

(1) the species of fish, (2) state of freshness of the fish raw material, (3) kind and amount of batter and breading mixtures, (4) frying technique, including type of oil used, its temperature, the frying time, and the oil replacement rate, (5) packaging materials and methods and (6) freezing and frozen storage conditions.

All the commercial products and the experimental lots are examined when first prepared, then periodically examined during the frozen storage period, to establish the essential attributes to be used for the proper quality grading of the sticks. A typical organoleptic examination sheet used by the staff includes the following factors:

(1) Shade or brilliance of color at the "ready-to-eat" stage. Color evaluation is far more precise at this stage than if judged in the frozen or thawed, but not heated, sticks. The shade designations are arbitrarily assigned numerical values ranging from one for a very pale product, differing little from the uncooked item, to 10, for a very dark product not quite at the burned stage. The shade most preferred by the test panel had a value of six. Several commercial lithographed labels of fish sticks were used as guides to designate values within the range from four to seven of this scale.

(2) The appearance, odor, texture and flavor of the breading and its absorbed frying oil. These same observations are then made on the meat of the cooked fish stick.

(3) After these latter characteristics have been graded as excellent, very good, good, fair, poor, or inedible, the over-all grade is assigned. Each characteristic is scored and tabulated separately to prevent several high scores masking a low score given to an undesirable characteristic. Ultimately the descriptive terms are converted to a numerical value so that relative differences of many test samples can be more readily compared.

(4) General remarks on the presence of undesirable features. Bones are objectionable since fish sticks are being promoted for children's lunches. The outer appearance may be marred by the presence of burnt bread crumbs. Dark streaks due to the presence of skin particles or abdominal membranes in the flesh portion are offensive. The breading may be loose from the flesh or it may be soggy from either excessive moisture or frying oil.

Chemical and physical objective evaluations are used to check the opinions of the taste panel. Some of the procedures used include:

(1) Measurement of the oil content of the fish stick and of the bread covering, by solvent extraction.

(2) Measurement of the degree of rancidity of the oil in the fish stick. This test reveals the use of frying oil in poor condition on relatively freshly-prepared sticks or the susceptibility of the oil, in the initially acceptable stored frozen stick, to the development of undesirable changes during storage.

(3) The texture of the thawed fish stick is measured by a device registering the force required to shear through the fish stick. This test is a check on the taste panel's evaluation of the texture of the sticks. Some frozen fishery products develop an undesirably chewy quality, or even a tough texture, during storage.

These observations may be used as a basis for the draft of a voluntary federal standard for fish sticks. It is too early to be sure of all the essential details, since much work remains to be done. However, some idea of the form such a standard might take may be helpful in describing the attack on the problem.

The first item required is a definition of the product. Since there is no mandatory standard of identity to incorporate by reference, some statement descriptive of the product serves as a starting point. The definition should be broad enough to include all the products now being marketed throughout the country, with the matter of diverse styles being covered elsewhere in the standard. For this discussion only sticks of the breaded, fried and frozen style are being considered. The United States Food and Drug Administration regulations on fill of container would, of course, apply to fish sticks, and

their standards of quality would be the minimum level upon which these voluntary grade standards might build to improve the product. Next, the product unit size should be designated and the grade nomenclature established. With these guide lines a description can be given of each attribute of the product, as now marketed, that directly affects its desirability. Sub-headings are usually necessary under the major attributes of appearance, flavor, and absence of defects. The inherent characteristics of the product and workmanship used in the preparation of the raw material and in the process of manufacture, must all be given consideration. A point score system, with a definite range assigned to each attribute used in the measurement of the product's quality, should be established at this stage.

By using the laboratory work and the partially complete data as general guides, a generalized draft of a voluntary federal standard of quality for precooked style fish sticks can be formulated.

A definition of fish sticks is: Items made by applying batter and breading to uniform, rectangular, elongate pieces of flesh from the species of fish indicated on the label, which are deep fried in a suitable oil. (Some statement of the acceptable range in per cent of breading material on the fish sticks would necessarily be a part of the definition, but at present there are not sufficient data upon which to base recommendations for this.)

Product unit size: a fish stick, as defined, with a gross weight per unit of one ounce. (As was stated previously, alternative sizes would be covered in any standard prepared.)

Grade nomenclature and definitions: Grade AA—to be of quality "AA" the product must be of a uniformly golden brown color, and after heating not over 10 per cent, by count, of the units may vary markedly from the predominating color. The odor and flavor shall be that characteristic of good quality fish of the species when fried in a suitable oil. The product shall be uniform as to size, with not more than 10 per cent, by count, of the units consisting of non-uniform or misshaped pieces; no broken pieces are permitted. No carbon specks, bones, skin or scales may be present. Good texture of the product shall include moderately crisp exterior surfaces, no noticeable separation of the breading from the fish portion, and no excessively moist or oily condition in the breaded layer. The fish flesh shall be well-cooked, tender and practically free from sogginess. A point range in the grading scale would be assigned these major attributes. For example, fish sticks that possess good color may be given a score of 17 to 20 points on this attribute. Those having good odor and flavor would score another 26 to 30 points. Fish sticks practically free of the undesirable features listed would be scored in the point range of 26 to 30. Acceptable texture would result in an additional score of 17 to 20 points. A total score of not less than 90 points would be required for the "Grade AA" rating.

Grade A—to be of "A" quality the product differs from "Grade AA" essentially in that the term "good" is replaced by "reasonably good". Not over 20 per cent, by count, of the units may vary from the predominating color; not over 20 per cent of the units may be of irregular or misshaped pieces, with no broken pieces. Exterior surfaces may contain no carbon specks. Texture is slightly less desirable than in "Grade AA", but still reasonably good. The point ranges for this grade might be: color, 13 to 16; odor and flavor, 13 to 16; defects, 22 to 25; and texture, 13 to 16. Minimum total

score for "Grade A" would be 78. A substantial portion of the commercial pack should qualify for this grade.

The remaining grades for fish sticks might be similarly established, possibly with "Grade B" at a score of not less than 60. Any product not rating over 35 would fall into "Grade C", which would be a sub-standard category allowing considerable variation in conformity to color, size and shape. A given per cent of broken sticks, some separation of breading from the fish and a reasonable amount of carbon specks would be allowed. Considerable loss of the characteristic good flavor and odor might be accepted here and some slight undesirable flavor and texture changes tolerated.

We are continuing the study on standards, in close cooperation with the industry subcommittee, to insure a realistic and workable standard for use if the government is asked to initiate this valuable aid in the marketing of this fishery product.

Standards Voluntarios Federales para Croquetas de Pescado

CHARLES BUTLER

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Abstracto

El éxito fenomenal de las croquetas de pescado en el mercado debe ser fomentado para asegurar aceptación entusiástica de este nuevo producto.

Con este fin, un grupo de productores en la industria organizó un Comité de las Croquetas de Pescado en la Convención de Cleveland en abril de 1954. Este Comité pidió da cooperación del Fish and Wildlife Service para obtener información sobre standards voluntarios federales para croquetas de pescado.

Los standards se basan sobre el siguiente criterio.

a) El color de las croquetas

b) La apariencia, color, textura y sabor de la harina y aceite así como la carne

c) Defectos presentes; por ejemplo, presencia de espinas, piel, manchas oscuras y otras caracteristicas no deseables.

How Voluntary Quality Standards Work in the Frozen Fruit and Vegetable Industry

HARRY K. SCHAUFFLER

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Something like the notes of reveille which awaken a slumbering military camp to action, I would like to sound off a few preliminary notes to remind

you of the size of the job ahead of you. During the last 55 seconds, five babies were born in the United States. In the next 20 minutes, over 100 more will be born. 1954 will welcome over four million new babies—over four million prospective new customers for you. What are your plans for them? How well will you discharge the moral responsibility of offering them ever more nutritious, more delicious food? Will you act as if every one of them were your own flesh and blood?

The frozen food industry as a whole has big plans for expanded service. In 1954 over six billion pounds of frozen foods will be consumed, about a 350 per cent increase in 10 years. Future prospects look even brighter for more and more customer enthusiasm over the time-saving convenience, elimination of seasons, and peak-of-perfection freshness made so widely available through quick-freezing.

While it is true that the modern bride is more tempted to serve frozen fillets, or fish sticks, or breaded shrimp than when it was necessary to start a meal by cleaning or deveining raw seafood, yet United States statistics show only a meager growth of about 12 per cent in the national seafood pack frozen in the last 10 years. Challenging the seafood producer is the brighter record of home freezer capacity—a 7,500 per cent increase in the last 8 years!

It is important to determine how ocean products, which pioneered the frozen food industry, can cease being laggards and move ahead to gain prominence in the freezer cabinets of today. Certainly the modern housewife welcomes the new convenience of frozen seafoods, but, too often perhaps, she is dubious about seafood quality and whether the family would be satisfied to have her repeat these frozen time-savers. Otherwise there would seem to be little reason for such an all-time record high in supplies of frozen fish and shrimp backed up in refrigerated warehouses this month.

In considering the vitally important objective of raising quality standards, examine the experience of other frozen foods with voluntary grade labeling. The U. S. Department of Agriculture has promulgated standards for grades for 11 frozen fruits, 5 juice concentrates and 18 frozen vegetables, plus cooked squash and French fried potatoes. Some standards for grades are new this year; others have been in use for a decade or so. Such grades offer both advantages and disadvantages.

Several points on the asset side deserve stressing. It is easy to become a processor as every gardener with a home freezer knows. Many of the smaller processors among the 1,000 and more in this young industry have found the official grades to be a useful measuring stick and have learned to pack more uniform quality products.

An important contribution of grades to a rapidly growing industry, always short of cash for expansion, has been to facilitate the obtaining of loans on frozen foods in warehouses. The banker making the loan is not basically interested in the flavor or nutrition within the package but rather in such specification of grade as may help to determine value. Grades, in like fashion, are useful in the settlement of damage claims.

Many of our independent frozen food distributors, just as in the case of chain store buyers, own private labels themselves, or jointly with cooperating firms. These buyers find government grades a useful shorthand in helping specify their needs since they lack personal inspection by their own repre-

sentatives at the packing plant. The buyer usually knows, however, the kind of product which comes from a packer and he expects to sample the lot upon receipt.

Probably the most advantageous use of official grades is in selling frozen fruits and vegetables to large institutional users. Where hundreds or thousands of personnel are fed in industrial plants, hotels, hospitals, or government establishments, the buyers frequently must decide between raw or frozen products. Besides the convenience and the lack of waste, frozen foods have the great advantage of offering uniform quality, whereas raw produce is highly variable. Yet the buyer must be sure of obtaining the promised uniform quality when the feeding of so many is involved. Official grades help to give him that assurance.

Government agencies and many other establishments specify that grade certificates accompany bids. If there is a dispute between buyer and seller as to grade at the time of delivery, the official inspector acts as an arbitrator.

Against the advantages for voluntary government grading cited above must be weighed some of the disadvantages that the frozen food industry have found.

Notwithstanding any printed specifications, grading decidedly depends upon judgment and is subject to human fallacy, temptations and disagreements. One packer, for example, reports taking a substantial loss to get rid of a Grade C vegetable to a broker—and thereby lost out on a big government order! The broker had had the frozen lot reinspected and found he could present a Grade A certificate and an unbeatable low price to the government purchasing agent. Another packer who pays for continuous government inspection states that it is only human nature to expect the government agent who is going to live with him to favor him.

Past experience indicates that the differences in judgment may be clearly demonstrated when a new inspector replaces an older man. The new man does not have the experience and knowledge but may follow his instruction sheets literally. As a result there will be a noticeable difference in the grades which these men give to the produce.

Unfortunately there is a good deal of waste of the customer's and/or taxpayer's dollar involved in grade labelling. The Florida Citrus Code, for example, assesses producers for United States Department of Agriculture inspectors acting as agents of the State. It seems to be general industry opinion that not much, if any, attention is paid thereafter to the grades. One packer observed that he has yet to see a shipment labelled "sub-standard". Maybe the inspectors eat what they reject. Anyway, he estimates the needless cost to the industry at a half-million dollars.

Another packer points out that there may be virtue in grading a frozen product to determine whether it is acceptable or unacceptable under industry standards, just as poultry or meats are inspected (or the "sterling" stamp is permitted on silverware) but he suggests that the real waste is in trying to define official degrees of mediocrity. His frozen brand uses more detailed inspection criteria for its own protection (A1, A2, A3, B1, B2, B3 etc.) and he finds that their "B2" will regularly receive an "A" grade if submitted to a government inspector.

The advantages that official grades offer frozen food packers, wholesale distributors, or chain store private label and large institutional buyers in

dealing with their principals have been cited, plus some stumbling blocks which you should evaluate. Those consulted are all experts within the trade, qualified to judge what a grade means, and equipped to sample large lots prior to acceptance.

Any advantages to the homemaker of grade labelling on retail packages have not been cited. This is because responsible members of the frozen food industry generally agree that she will not be better informed, but rather misinformed. It is the old story of a little knowledge being a dangerous thing. Take every precaution to protect health and safety and honest measurement for each family—but don't try to tell the individual what his taste should be!

Suppose there were a hundred samples of peas from a hundred growers scattered from coast to coast. Suppose a hundred individuals judge which are A, B, C and D. How would each decide on the degrees between smooth and wrinkled, large and small, too green and too pale, more or less tender, more or less mature, more or less nutritious, insipid or delicious. How would each weigh all these varying degrees to determine which are Grade A. How few would agree! Yet why is the government inspector qualified to tell anyone that he doesn't know what he likes in peas. Favorite foods are reordered because of their flavor, and for children because of the nutritious value believed to be present. But neither flavor nor nutrition is graded by the government inspector and the grades do not mean quality of appeal to the ultimate consumer.

It is suggested that voluntary grade standards deserve study as possible tools of value within the trade itself, but that they should only be used between experts where they can be of demonstrable value because they are fully understood. Their very A-B-C simplicity is misleading to the uninitiated, just like the druggist's pills which the doctor and the law cautions against issuing except on prescription.

You are confronted with a grave responsibility as your products move more and more through frozen food cabinets. Where formerly the housewife inspected and even smelled the raw product for herself, or at worst placed her trust in her friendly grocer, now she and he see only a package. You, the seafood processor, have assumed her responsibility for the quality of the raw material and its preservation. Keep faith with her. Give some thought as to why the precautionary inspection of fish and shell-fish should not be just as important a government service as in the case of turkeys or pork. Consider what other industries have done without government aid. For example, the Underwriters Laboratory seal of inspection on a radio set assures you that forgetfulness in leaving it turned on during a trip will not result in your house catching fire.

The Shrimp Association of the Americas deserves every support for the standards which were approved last July in Mexico City. The acid test of accomplishment will be the extent to which they are observed and enforced, and progressively raised as the industry is able to improve its techniques.

You will have to compete for space in the frozen food cabinet with every other packer of frozen meats, poultry, prepared foods, etc. For your own selfish advantage it would seem obvious that every seafood leader should join with every other leader to raise industry standards and win customer

enthusiasm. The successful distributors who are members of our progressive National Wholesale Frozen Food Distributors Association like to do business with that kind of leader.

Como los Standards Voluntarios de Calidad Trabajan en la Industria de Frutas y Verduras Congeladas

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Abstracto

A pesar de que el consumo de alimentos congelados en los Estados Unidos ha aumentado 350 por ciento en 10 años, el empaque de productos marinos congelados solo ha aumentado un 12 por ciento. Con un incremento de 7500 por ciento en capacidad refrigeradora en el hogar en ocho años, la industria de mariscos tiene un enorme mercado disponible.

Parece que la falta de los productos pesqueros congelados en mantenerse a la par del resto de los demás productos alimenticios congelados, es lo que causa que la ama de casa dude la calidad de los mariscos ofrecidos. Standards gradatorios parecen ser necesarios. Los standards facilitan el obtener préstamos sobre productos congelados en las bodegas, y son muy útiles para ayudar en la venta a compradores de instituciones grandes. Standards gradatorios aún dependen del juicio humano y será difícil en la pràctica el obtener una uniformidad estricta. La utilidad de los standards depende en la forma en que estos son observados y enforzados.

DISCUSSION

Industry Session

Discussion Leader: JAMES E. BARR

Discussion Panel: LOUIS FISCHER, J. C. FERGUSON, J. ROY DUGGAN, PEDRO PINSON

Voluntary Government Standards For Fishery Products

A. W. ANDERSON

Q. Fieger: Mr. Anderson, don't you feel that with frozen food there is the same problem as with fresh food, in that from the time it leaves the plant until it gets to the consumer you don't know what kind of handling is given to the material. I think that we need a lot of education in the stores on the proper handling of frozen foods.

A. Anderson: I would agree, except in degree. I think that the problem is very difficult with fresh fish but not so much with frozen fish, and, of course, much less with canned fish. In collecting samples for the National Fisheries Institute annual "cutting" we have found that there is a great variation in the care taken of frozen fishery products in grocery store freezer cabinets. As our men go around and pick these fishery products out of the cabinets, just exactly as a housewife would, they also take the temperature of the cabinet and the temperature of the product in the cabinet. Frequently the cabinet will show a zero temperature and the product in the cabinet may be 25°. We find also that the packages in the cabinet apparently aren't changed as new products come in. These packages are not necessarily put on the bottom so that the first in are the first out. That seems to be a very serious problem that not only affects fish but also other types of frozen products. It seems to us, on the basis of what experience we have had in the last few years, that one of the biggest needs in the frozen foods industry is a cabinet that would insure that packages put in first would come out first. Checking with various fish companies we have been told that they have found through the code marks on their samples that some of their fish products have been out a year, and they know they have been in cabinets for long periods of time without being moved.

Q. Strasburger: This morning you mentioned, in passing, the use of standards for trading on futures markets. Would you care to enlarge on that?

A. Anderson: Four or five years ago, at a National Fisheries Institute convention in Chicago, the matter of trading shrimp on a futures market was considered. A man from the mercantile market in Chicago explained how various products, e.g. turkeys and onions, were traded on the futures market. This was primarily as a "hedge", or as insurance to protect the company if prices advanced or dropped rapidly. But he made it quite clear that it would be impossible to trade any product on a futures market unless there was a standard for that product, because when you buy a product on the futures market you don't necessarily get delivered exactly what you bought, but rather the "equivalent" of it. So if you bought U.S.#1 shrimp at a certain time you would get a carload of that grade at a later time, but not the same carload that you bought. And obviously under these circumstances you have to have standards for the products you deal in.

Schauffler (Comment): The latest addition in the futures market is in the poultry business, where frozen poultry is now quoted every day for sale on the futures market in New York.

Q. Barr: Is it necessary, to make voluntary industry standards a success, to have it subscribed to by the whole industry?

A. Xavier: Voluntary standards would involve just exactly what it says, *voluntary*. However, we feel that in order to have these standards there has to be cooperation between the industry and the government agency that is responsible for that particular product. Therefore, before the standards can be established, there would have to be some idea as to what percentage of the industry would be willing to go along before the government would step in to help out with the standards. I am inclined to agree with Mr. Anderson that we should have approximately 50 per cent of the industry agreeing to the standards, because one of the main purposes of the standards is to give the consumer a high quality product and if less than 50 per cent of the industry is going to go along the public is certainly not going to get the product that it deserves.

Q. Pinson: I wanted to elaborate on Mr. Barr's question. It takes us to the financing of an inspection system for quality control or standards. Do you think that everybody in a certain industry should carry the weight of the financing or should it be individually those plants or groups that would want to use those standards?

A. Xavier: On voluntary standards the people who subscribe to the standards would naturally be the ones that would have to contribute to the setting up of the service. If you have compulsory standards, which naturally would have to be government standards, then it would be up to the government to foot the bill and everyone then would contribute indirectly through taxation.

Q. Duggan: We have made quite a bit of progress, I believe, in developing what would be voluntary standards in breaded shrimp. It was my understanding at the last meeting that possibly 75 per cent of the industry, volume-wise, was represented and was in favor of the tentative standards that were set up. I know it takes longer for the Food and Drug, for example, to set up permanent standards, but is there anything that would prevent them from enforcing industry standards which were set up on a voluntary basis and represented approximately 75 per cent of the volume produced? And if not, when are they going to start giving some enforcement to the ones that have already been agreed to?

A. Xavier: The standards for breaded shrimp which the committee set up, were tentative standards, and at the two meetings that we held, approximately 75 per cent of the production was represented in person or by proxy. I believe 5 or 10 per

cent later indicated their approval of the standards. Then it became necessary to go to Food and Drug and ask them what they thought about the standards and whether they would approve them or not. Food and Drug wouldn't tell us yes or no because they didn't know, and they suggested that a survey be made to find out what the consumer wanted. I learned some time ago, since our Cleveland convention, that the Fish and Wildlife Service has started a consumer survey along these lines. Possibly within a short time we should learn what the consumer preferences are concerning breaded shrimp.

Q. Ferguson: We know that on a government order for breaded shrimp a certain proportion of breading to shrimp is specified. Outside of that, this argument about the amount of breading in proportion to the shrimp concerns what would constitute a "good quality" pack. If I remember correctly, in your paper this morning there was a variance of about 20 to 60 per cent in the amount of breading in different packages of shrimp. Has it been determined yet what would constitute a "good" pack in relation to the breading of the shrimp?

A. Xavier: No. The general consensus of those in the industry, however, is that, for sizes of up to 42 count the breading should not be over 42 per cent of the net weight. Over 43 count, that is smaller shrimp, it can go to 50 per cent breading.

Q. Fischer: Mr. Xavier, do you think that the trade associations, such as the Southeastern Fisheries Association and National Fisheries Institute, should enter into a program of certain standards for their members?

A. Xavier: The standards would have to be industry standards, or we might run foul of the law. We haven't quite gone into the matter that far, but I am sure that any standard set up would have to be industry-wide and not just National Fisheries Institute or Southeastern Fisheries Association standards. I'm afraid that Federal Trade Commission might object to that.

Quality Standards For Crab Meat

LORAIN SZABO

Q. Duggan: Some plants operate primarily on crabs that are caught in traps or caught on trot lines; the ones that come into the plant live and kicking are certainly better than those that are caught in shrimp trawls and have been dragged for perhaps two hours, some of them coming on deck actually dead. Have you noticed any difference in the bacteria counts on the crabs from these sources?

A. Szabo: We haven't made a comparison between these two types of crabs. By the time crabs caught in any of these ways have been cooked there should be no difference in bacterial loads because the ideal cooking temperature-time pressure relationship should take care of all the contamination that previously existed. The purpose of the cooking is to kill the bacteria.

Q. Duggan: But some of these crabs that have been caught in the shrimp boats and that are not properly iced are actually spoiled before they are delivered to the crab plant. You don't mean that by cooking you're going to get rid of the decomposition.

A. Szabo: That raises another point. If some of the crabs have died, and they have been in the heat for a long time, certainly much decomposition will have taken place. No cooking will alter that, and that is certainly something which the crab operation has to reckon with. Some of the operators try to be careful and discard any dead crabs, but this depends upon the integrity of the crabbers. In the Florida-Georgia area the crabs are loaded in metal drums, and for all the producer knows, the bottom of the drum may be full of dead crabs, and he won't learn that until he's ready to cook them.

Q. Pinson: How is crab meat packed and about what percentage is sold frozen and what percentage fresh?

A. Szabo: Crab meat is usually packed in one pound tins, and is usually sold in the fresh form, that is, shipped under wet refrigeration. The principal markets are in the N. Y., Washington, Philadelphia areas, where the people like the fresh delicate flavor of crab meat. There is very little sold as a frozen product because it is difficult to freeze crab meat without seriously affecting the flavor, and causing it to become badly dehydrated. There is some crab meat canned, but the gourmet prefers a fresh packed product.

Q. Fischer: I understand that some packers are putting up crab meat in sealed tins, under refrigeration. Can you tell us about this?

A. Szabo: Some years ago the Fish and Wildlife Service experimented with pasteurized crab meat, with some interesting results. We've tasted some of the pasteurized meat and we noticed that unless the packer is careful with the pasteurization process, the meat is slightly discolored, also, it might have a carmalized flavor and be a product different from crab meat. It is possible to produce a product that resembles fresh crab meat in flavor, color and textures, but it's going to take a little work before the gourmet will accept the pasteurized product in lieu of the fresh packed product. The temperature of pasteurization may range from 160° F. to approximately 211° F. and of course the higher the temperature the shorter the time of treatment.

Q. Fieger: What was the range of the total bacteria counts on the 400 samples that you ran?

A. Szabo: There are two ways of handling crabs after they come from the retorts. In areas south of North Carolina the hot crabs are dumped upon a concrete or other solid table to cool them. The cooking process is finished about 10:00 p.m., and the crabs are left there until a crew of packers comes in at about 5:00 in the morning. North of the Carolinas the operations are considerably smaller and it is possible to leave the crabs suspended in the cooking baskets. In northern areas there is faster cooling of the crabs. On the mass of crabs on a table in the southern areas, we ran bacterial counts on crabs from various positions in the fill. In the middle of the stack there might be 5,000 to 600,000 per gram while at the botttom of the stack the count was innumerable. This proved to us that this method of cooling is a bad one, and we have convinced some of the packers to alter their methods.

Q. Robas: Is there any practical reason why a batch of cooked crabs could not be plunged in the chlorinated ice water as they are removed from the cooker?

A. Szabo: We feel that the less water there is around the crabs during the cooling process the better, because even though the crab shell is good protection, there is not much protection around the joints, which are possible sources of entrance of bacteria. Also, with a large operation handling 25,000 to 50,000 pounds of cooked crabs, it would be quite a problem trying to dump the baskets into chlorinated ice water. We don't like to get too much water on crabs at this stage unless picking operations can begin immediately, and sometimes that's not very practical. So even after you have cooled them and had to let them remain on tables several hours, you might undo some of the good you have tried to accomplish.

Q. Xavier: How long can you keep a can of fresh crab meat under wet refrigeration?

A. Szabo: This depends on the bacteriological quality of the can of meat to begin with, but with meat of good bacteriological quality (and by good I would mean one that meets the proposed standards that New York City is going to put into effect), I would say that the meat should keep ten days to two weeks under wet refrigeration.

Q. Whiteleather: Is there any one in the industry who is dating crabmeat so the consumer knows the age of the meat that he is buying?

A. Szabo: As far as I know, that is not a general practice. It is a good idea but the way the sale of crab meat works the larger producers ship to commission merchants and here there may be many a slip between the cup and the lip. The product may have been good at the time it left the plant, and also at the time that it arrived at the commission mer-

chant, but if his sales are slow and he has had the meat around for a week or ten days under questionable conditions of storage, and not wanting to lose his product, he will try to sell it anyway. There is where coding would be of a real help.

Whiteleather (Comment): I know one retail outlet which coded its crabmeat and this company increased its sales about 6 or 7 times in a short period by dating the product and not keeping any crab meat in their cabinets beyond a two-day period. They had other outlets, of course, and the meat they didn't move through the cabinets they make into crab meat cakes on the third or fourth day. This struck me as such a fine piece of merchandising, and represented so much progress in the matter of handling crab meat that I wonder why it wasn't continued and why it wasn't more common.

Q. Franco: I would like to ask Mr. Szabo about the food poisoning due to crab meat in New York.

A. Szabo: I understand that in all cases of food poisoning that could be directly attributed to crab meat they have found it due to the hemolytic staphylococci, the same kind of bacteria that causes food poisoning from spoiled cream puffs and the like.

Shrimp Industry Standards of Quality

LAWRENCE W. STRASBURGER

Q. Pinson: Isn't there a certain obsolescence in the type of packing we're all doing? A very high percentage of our production is packed with the shell on in 5 pound cartons. Is it possible that the market isn't willing to take this product in these quantities?

A. Strasburger: I am not a marketing specialist; however, I have seen a number of ways in which shrimp may be prepared, still in its uncooked or unprocessed form, which I believe will give additional marketing opportunities. As to the second part of your question, I do not believe that the market is saturated for shrimp in frozen 5 pound cartons. At the present time, we are faced with a relatively large inventory. There are a number of factors which have caused the holding of large inventories, part of which can be attributed to two things. One of them is the very high prevalent prices of the spring and fall of 1953. The high prices also caused a lot of poor quality shrimp to be placed on the market. These factors caused a lot of people to stop eating shrimp, and to keep it off the menus so that at the present time it may seem that we have reached the saturation point. But good quality shrimp, placed on the market properly and properly merchandized, can be sold. I don't believe that the saturation point has been reached yet by any stretch of the imagination.

Q. Duggan: This morning when discussing the matter of standards you touched on what would be a maximum freezing time to produce a good quality product. You were talking there, I believe, primarily of frozen fresh shrimp but I am interested in it from the stand-point of breaded shrimp. We have long held to the belief that the quicker that we could freeze, the better product we would have. This is a view that is not exactly shared by some of our competitors. What is the scientific opinion on this?

A. Strasburger: There are several variables involved. Under our SAOTA standards for frozen headless shrimp we have put up a maximum freezing time of 24 hours. This is not the best, but in setting up any standards you have to bear in mind the general set-up in the industry as it presently exists, and while in time you may be able to encourage gradual changes in certain physical equipment, you can't get everyone in the industry to change all their equipment overnight. Insofar as breaded shrimp is concerned, I believe the freezing time should be much faster than a 24 hour period. You must bear in mind that in breading materials there are eggs, milk and some highly perishable proteins which make it a wonderful bacteria medium, so that breaded shrimp should be frozen at a much faster rate than frozen headless shrimp.

Q. Ferguson: Boats out of Ft. Myers usually carry three men, but during the low months of production on Campeche Banks we have several boats that try to get along with two men. We have noted consistently that those two-man boats have brought in a poor quality of shrimp. Have you found the same situation existed in Texas or elsewhere?

A. Strasburger: At any time that you have long periods of exposure of shrimp on the deck of the boat the poorer will be the quality of the shrimp. In this case, apparently, two men cannot get the shrimp on ice fast enough.

Q. Fischer: What percentage of the shrimping industry is grading their shrimp as to size? Is this helping in the control of quality?

A. Strasburger: It's rather hard to give a percentage figure. The *frozen* shrimp industry of the west coast of Mexico is grading its shrimp 100 per cent. *Fresh* shrimp shipments from the west coast of Mexico are not being graded to any great extent before they are shipped into the United States. The east coast of Mexico, which does not produce any fresh shrimp, is also grading 100 per cent. Texas, within the last two years or three years, has shown a tremendous increase in the amount of grading of shrimp. I would hazard a guess that at least 75 per cent of the shrimp being frozen in Texas is being graded. In Louisiana the major portion is not being graded. In Mississippi a large number of graders have been installed. Alabama follows approximately the same pattern of Louisiana. In Florida there have been some plants which have installed graders, but the principal producers do not grade them.

The grading of shrimp is a very definite quality factor. Buyers and restaurateurs are looking for "portion controls" and unless shrimp are graded for size they cannot go into portion control.

Q. Kahn: Mr. Strasburger, you described in detail shrimp quality control, but what would you say about the responsibility of the plant after shrimp have left the plant? Going back to my personal experience as manager of a potato marketing association, the potatoes travelled over 2000 miles from the point of production to the point of marketing. When prices went down usually the potatoes arrived in bad shape; when prices went up they usually arrived in good shape. I think something similar may happen in the shrimp industry when shrimp are shipped from the producing area, say in Texas, to marketing and consumption areas, say in Chicago. We attempted to solve the problem by having an inspector, appointed by the Association, in the producing area and another one in the consumption area. Do you have in mind to establish control at the point of loading and at the point of receiving, and how should shrimp be controlled in the freezers in Chicago and other consuming areas?

A. Strasburger: Under the standards for quality control which have been adopted by the Shrimp Association of the Americas, there is no provision for control to be exercised after the shrimp have left the producer's warehouse. While there is marked room for improvement in quality control in the marketing of the product, this is something that is completely beyond the producer's power. It could possibly be handled through a warehousing organization.

Q. Sanchez: About a week ago in the markets of Havana, I found some shrimp from India, bound for Atlanta. They were beautiful shrimp, about 15-20 to the count. They were retailing for 60c a pound. I understand that in the United States they market for 65c a pound, frozen in a 5 pound box. I wondered if there was any reason for dropping the shrimp into Cuba or whether that shrimp was difficult to enter into the United States because of high duty there. Maybe the quality was not what they wanted?

A. Barr: There is no duty on shrimp entering the U. S. A. As to the price that they are retailing for here, of course that depends a lot on the cost of the importer. Certainly we have no control over that at the present.

Voluntary Grade Standards For Fish Sticks

CHARLES BUTLER

Q. Barr: Have you noticed any change in quality after temperature fluctuations, comparing fish with breaded shrimp, due to

the greater quantities of oil present in fish than in shrimp? Do you think it is necessary to hold breaded fish sticks at a more constant temperature than breaded shrimp?

A. Butler: No, fluctuations in temperature do not affect the oil; however, at high enough temperatures the oil would become rancid if any air was present in the package. A good practice is the use of stabilized oil for cooking.

Q. Pinson: What effect do you think the time required for freezing would have upon the maintenance of quality during the storage life?

A. Butler: The effect of the rate of freezing shows up in a number of ways during the storage period. First of all, contrary to what has been argued for many years, the particle size of the ice crystals in the fish is not too serious with present methods of freezing. The breading material on fish sticks is very susceptible to bacterial action, and the fish itself wouldn't spoil as readily as the breading. During the storage period the changes that might take place would be largely in texture. A change might take place in the *flavor* of the breaded material as a result of fluctuation in temperature. If fish sticks have picked up an onion flavor, for example, this would be accentuated in the sticks during the storage and fluctuating temperatures would aggravate it. But fluctuations in temperatures *per se* shouldn't greatly change the over-all flavor, there would be more of an effect on the texture.

Q. Menzel: Do you think it would help the sale of fish sticks if the packer told exactly what species it is? I think they state that it is one of several species and some people have preference as to what kind of fish they eat.

A. Butler: According to the Food and Drug regulations, the label can say "cod or haddock" and does not have to tell how much of either one. But it can't say "cod, haddock or ocean perch," any longer. Ethically the label is supposed to say specifically what the species is, and that is the recommended practice.

How Voluntary Quality Standards Work In the Frozen Fruit and Vegetable Industry

HARRY K. SCHAUFFLER

Q. Duggan: Is there now a probability that a government grade, A, B etc., will be required on frozen food labels?

A. Schauffler: That has been urged at one time or another and it has been used on a voluntary basis by particular brands where it was thought that an advantage would be gained. I don't think that there is any serious thought at the present time to make this compulsory. I would have to disagree with Mr. Barr when he said it would be necessary to have at

least 50 per cent of the industry agree to voluntary quality standards before they could be successfully introduced. It seems to me that the percentage is not so important as the shouting, the propaganda, in connection with putting the grade on a particular package. If you stop to think about the things that we have seen happen in the last year outside of our business, it was not 50 per cent of the cigarette people that decided that it would be a good idea to put in a filter. It was just one or two small firms which started the filter and now all of the big companies are putting a filter on their product. It didn't require 50 per cent for that! I mention that because I think that in the food industry there have been individual firms which have done a great job of raising standards. One packer, we'll say in New Jersey, knows a good deal about lima beans. The best of the beans will be frozen. If the packer gets too many he will can some; the rest he'll send over to the fresh market. Similarly in Florida today a number of packers are not producing frozen citrus concentrate alone. They are shipping some cargoes to the fresh market because they say they aren't good enough for frozen orange juice concentrate. I challenge you people in the fish and shellfish business: Are you choosing the best of your raw material for processing, so that you can stand upon your record in three or six months from today, or do you say, "What we have left over we'll pack; we don't want it to spoil on our hands so we'll freeze it."?

Q. Barr: A problem which has come up repeatedly today concerns the lack of control of the packer over his product in the regular market channels. The onus for a bad package is on the producer. I've seen cases where shrimp were perfect when they left the producer's hand, but were declared bad when the buyer got them. I was wondering what would be the best approach to this problem, since it is one of distribution and handling.

A. Schauffler: The distribution of frozen foods is not by any means what it should be. We have been talking today about the processor and how he can improve the quality of the product in the honest belief that after it has been frozen and kept frozen it will not improve with age. Certainly if the distributor does a clumsy job the product can deterioriate. That does happen on the wholesale level and even more prevalently, I'm sorry to say, in the retail business. We have several educational campaigns on the importance of zero temperatures which are being conducted by different brands and by their distributors. One of the things we have found most difficult to counter is the misinformation about the costs of handling frozen foods. If the cost is driven down too low the corners are cut, with disastrous results to quality. We believe that if more sound information is spread as to the actual cost of merchandizing

and handling frozen foods and a proper markup provided for this, that quality will benefit.

There is also the question of whether it is desirable from a legal point of view to set standards. The state of Connecticut has actually passed a law stating, in effect, that frozen foods must be kept at "proper" temperatures. The enforcement agency is now worrying about what *are* the proper temperatures. Oakland, Calif., is also experimenting with this. They have had the law on the statute books for some length of time; the question is how we are going to enforce it. Enforcement can only be successful if the community is in favor of the law. A speed law is useful, but if nobody pays attention to it, it isn't worth spending the time to pass. If the community wants the speeding to stop, then the policeman can stop speeding.

Q. Kahn: Speaking again from my experience with potatoes, I would like to mention the use of highway inspectors at the producing points and at the marketing points. Would you think it would be feasible for the National Fisheries Institute or any trade association to hire an inspector at the main marketing points, say Chicago and New York, and to make the decision of these inspectors on the quality of the shipment the basis of the future marketing of fish?

A. Schauffler: That would depend upon the demand for such service, the same as in the case of requests for arbitration or for credit information. USDA does not provide free inspection for frozen fruits or vegetables at Chicago or New York. It would obviously not be reasonable to expect a trade association to provide an inspector without charging for him.

Q. Whiteleather: Do any fruits or vegetables in containers have a grade marking on the package so that the consumer can tell whether he is getting U. S. #1 or any other specific grade.

A. Schauffler: Yes, there have been several but they have not generally been the better known ones. Producers of the leading brands, on which there has been a lot of advertisement, have felt that they can stand on the brand's reputation. It has been the smaller producers who have not been in a position to advertise who have been more prone to use grade labeling, with, perhaps, the U.S.D.A. authority behind it, as advertising. Most of this kind of product happens to be aimed primarily to the institutional trade, so the grade sometimes appears only on the price list and not on the label.

Q. Whiteleather: This small producer with a private label that can't compete against a well advertised brand can guarantee quality by putting a grade on the package. Then why can't everybody else guarantee the same thing?

A. Schauffler: I think they can, but the question is whether it would be an asset to them. Obviously, the question in the mind of

owners of well known brands is whether their name will be enhanced by the addition of government grade labeling or whether they feel that their name is itself the asset that lends honor to a package because it is the "best known name" in the country.

TUESDAY—NOVEMBER 16

Chairman—H. C. Diehl, *Director, Refrigeration Research Foundation, Colorado Springs, Colorado.*

Further Experiments On the Control of Menanosis or "Black Spot" On Shrimp[1]

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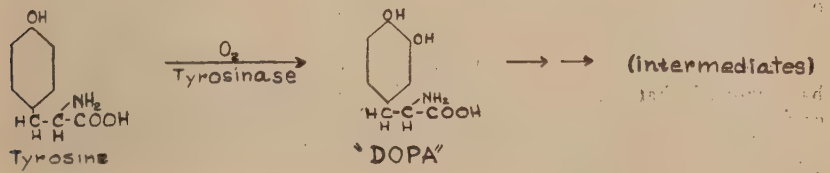
At the Fourth Annual Session of the Gulf and Caribbean Fisheries Institute the authors showed rather conclusively that "black spot" formation is catalyzed by an enzyme, tyrosinase, in which certain chromogens of the phenol amine type, resulting from the breakdown of protein, are converted to dark brown or black substances which are called melanins. The chemical change is as follows:



You will note that three substances are necessary for melanin or black spot formation: (a) a suitable substrate, in this case tyrosine or dihydroxyphenyl alanine (DOPA); (b) molecular oxygen or air; and (c) the enzyme tyrosinase, which is a complex of copper with protein. If any one of these substances is absent the formation of melanin is impaired or completely prevented. Knowing something of the chemical changes which result in black spot development should enable us to attack the problem of its practical prevention more intelligently. A list of a few substances which, in theory at least, should prevent melanin formation are:

1. Substances which combine with copper: thiourea, cysteine, glutathione, hydrogen sulfide, carbon monoxide and hydrogen cyanide.

[1] These studies were supported in part by a grant from the Wildlife and Fisheries Commission of the State of Louisiana.

2. Metals which compete with copper for union with the proteins: mercury, gold and silver.

3. Sustances which delay melanin formation: tween detergents, and changes in pH or acidity.

4. Substances which compete for the available oxygen or reducing substances: ascorbic acid, sodium sulfite, and sodium bisulfite.

While the above list is by no means exhaustive, it still offers a large number of compounds which could be used for preventing melanin formation were it not for the fact that the treated shrimp tissue is ultimately used as human food. The majority of these substances are toxic and thus could not be used. Then, too, there has to be considered the economic aspect involved in treating shrimp with chemicals. Naturally, the most desirable chemicals for study of problems of this type would be the so-called physiological anti-oxidants such as ascorbic acid, vitamin E, or some of the B vitamins, but these are too expensive at present to be employed in sufficient quantities in chemical ices.

Taking into consideration the economic as well as the physiological aspect, a study was made of the efficacy of certain substances for prevention of black spot. A preliminary experiment was designed to determine the effectiveness of various solutions as inhibitors of black spot formation. Shrimp tails were dipped in various solutions and placed in aluminum containers, which were packed in ice. The chemicals were classified according to the degree of protection against black spot development and were rated in the following order:

Single strength lemon juice; 0.1 per cent sodium bisulfite; 0.1 per cent ascorbic acid; 0.1 per cent sodium sulfite; ascorbic acid-citric acid 8-92 mixture; 0.1 per cent citric acid; 0.1 per cent tartaric acid.

On the basis of the above experiment, it was decided to evaluate further the two most effective, namely, lemon juice and sodium bisulfite. Nedvidek has reported that dipping fish and shrimp in lemon juice for either fresh or frozen storage resulted in prevention of rancidity and retention of flavors and color far beyond what could be expected from its citric acid and ascorbic acid content. He explains this enhanced action by the presence of bioflavonoids in the lemon juice.

Approximately three grams of shrimp shells were placed in 50 ml. beakers. Then 26 ml. of solution was added to each beaker, the beakers were covered with watch glasses and stored at 40°F. At regular intervals observations were made on changes in the color of the solutions and the development of black spot on the shells. All solutions contained 96 parts per million (p.p.m.) "DOPA" to insure ample supply of substrate for melanin formation. The series of lemon juice solutions were made by dilution of Exchange No. 309 Calemona Concentrated Lemon Juice*. This juice was a 5.5 to 1 concentrate and the concentrations are expressed on the basis of normal strength lemon juice. For the sodium bisulfite solutions a 1000 p.p.m. concentration was diluted to the various solutions used. The data are summarized in Table 1. Sodium bisulfite at a concentration of 125 p.p.m. was as effective as one-half normal strength lemon juice in preventing black spot on shells in the presence of "DOPA". In general, the samples stored under lemon juice had a much better odor than those stored under the bisulfite solution. Lemon juice solu-

* Kindly furnished by California Fruit Growers Exchange, Carona, California.

TABLE 1

The Effect of Various Concentrations of Lemon Juice and Sodium Bisulphate in the Presence of Dopa on Shrimp Shell Melanosis

All solutions contained DOPA at 96 PPM concentration

Solution and Concentration			Hours of Storage					
Lemon Juice			16	24	48	72	96	120
0.5	Normal	Strength	0	0	0	0	0	0
0.2	"	"	0	0	*	*	*	*
0.1	"	"	*	**	***	***	***	***
0.05	"	"	*	**	***	****	****	****
0.02	"	"	**	***	***	****	****	****
0.01	"	"	**	***	****	****		
0.005	"	"	****	****	****	****		
0.0033	"	"	****	****	****	****		
0.0025	"	"	****	****	****	****		
Sodium Bisulfite								
1000.0 PPM			0	0	0	0	0	0
500.0 PPM			0	0	0	0	0	0
250.0 PPM			0	0	0	0	0	0
125.0 PPM			0	0	0	0	0	0
75.0 PPM			*	*	*	*	*	*
37.5 PPM			*	*	***	***	***	***
18.8 PPM			**	**	***	***	***	***
9.4 PPM			****	****	****	****		

0 no change in color of solution or of shells.
* solution slightly pink, beginning formation of black spots on shells.
** solution dark pink, shells had few black spots.
*** solution brown, several black spots on shells.
**** solution black—large number of black spots on shells.

tions, in concentration as low as 0.02 (1/50) normal strength lemon juice, had no odor after 96 hours at 40°F.

At the same time as the above experiments were being carried out, experiments were also conducted on the value of various chemical ices for preservation of freshly caught brown shrimp *(Penaeus aztecus)* and prevention of black spot. It was previously shown that shrimp packed in ice containing 0.25 percent (2500 p.p.m.) sodium bisulfite or sodium sulfite were protected almost perfectly from melanin formation for 14 days (Bailey and Fieger, 1954). These shrimp were completely odorless during the first 12 days of the storage period and maintained their natural colors. Processing methods similar to those employed by commercial canners and housewives, however, failed to remove all of the sulfite from shrimp which had been packed in 0.25 percent sodium bisulfite ice for five days. In an attempt to preserve shrimp adequately, prevent melanin formation and obtain a cooked product essentially free from sulfite, lower concentrations of sodium bisulfite were used

in packing ices. In the first of two such experiments the following ices were used: commercial ice, sodium bisulfite ice (100 p.p.m. concentration), and ascorbic-citric mixture (8 parts ascorbic acid 92 parts citric acid 1000 p.p.m. concentration). The latter two ices were made by freezing small increments of the solutions in stainless steel pans in a plate freezer at —55°F. In this way, blocks of ice were made of quite uniform concentration. In order to obviate further the differences in concentration in various regions of the

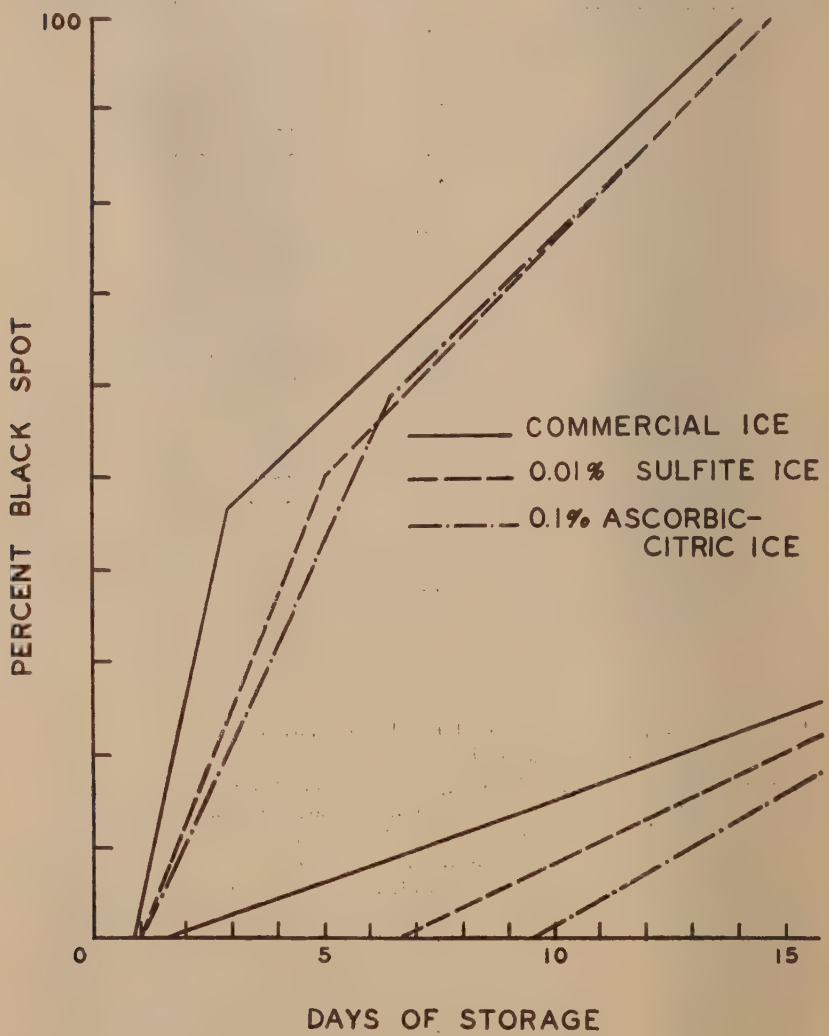


FIG. 1

blocks, the ice was shaved at right angles to the layers in a Snow King Ice Shaver. A sample of between 50 and 65 shrimp were removed daily from the three different types of ices, examined, and classified according to the severity of the black spots. Those containing only a few barely detectable black spots

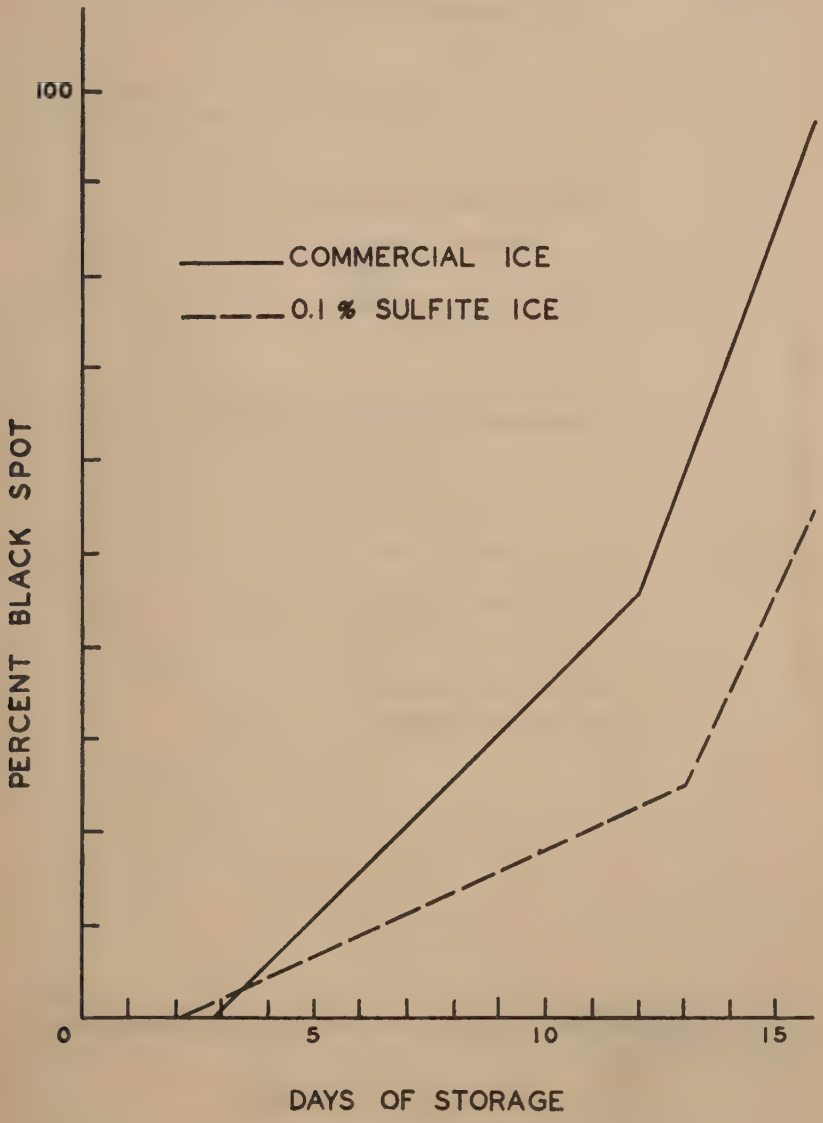


FIG. 2

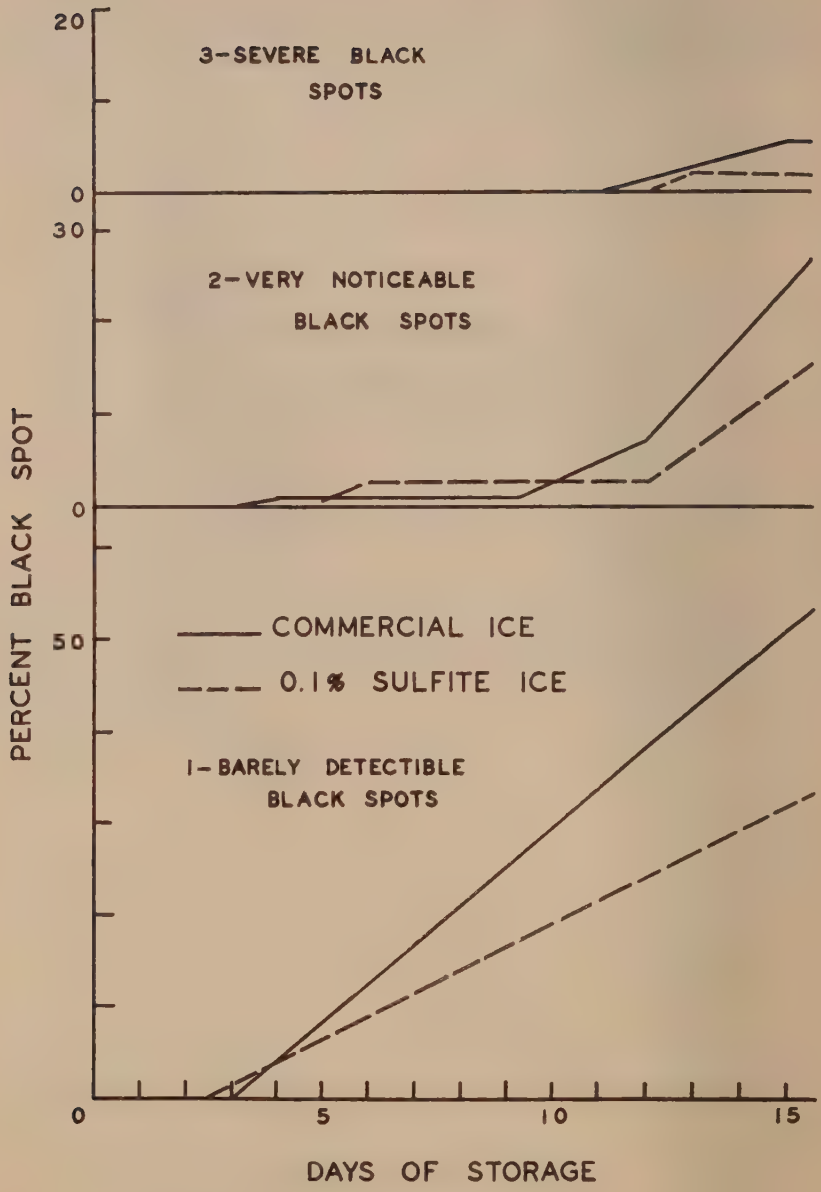

20
3-SEVERE BLACK SPOTS
0
30
2-VERY NOTICEABLE BLACK SPOTS
0
50
COMMERCIAL ICE
0.1% SULFITE ICE
1-BARELY DETECTIBLE BLACK SPOTS
0
5
10
15
PERCENT BLACK SPOT
DAYS OF STORAGE

FIG. 3

were separated from the ones containing severe black spots and the percent of each type was recorded. The incidence of these two classes of black spot is shown in Figure 1. The three upper curves represent the former condition and the three lower represent the latter condition.

The shrimp in ice containing ascorbic acid-citric acid mixture and those in

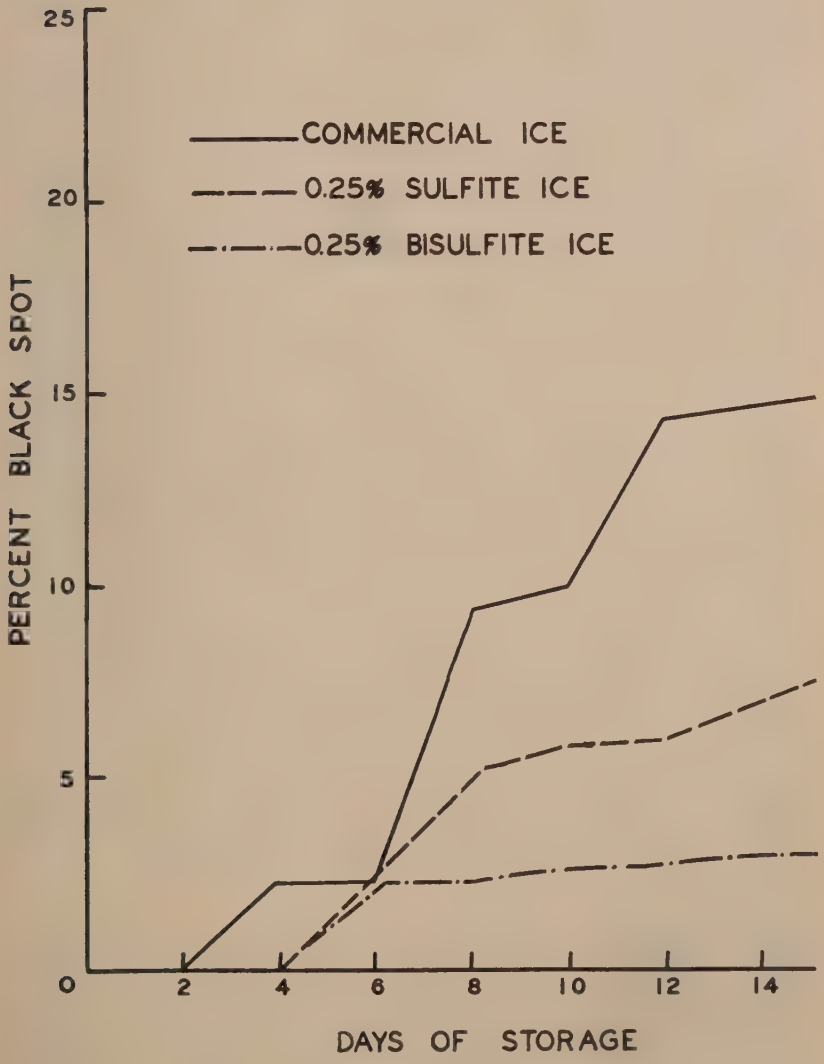


FIG. 4

ice containing sodium bisulfite had barely detectable black spots during the first five days of storage, and throughout the storage period had fewer severe black spots and were of slightly better general appearance than the controls. The shrimp stored in these ices were slightly firmer and had less slime through the first 10 days of storage in comparison with those stored in commercial ice. The sulfite treated shrimp contained only trace quantities of residual sulfite after washing and cooking. Neither of the chemical ices, at the concentrations used in this experiment, were sufficiently effective in the prevention of black spot to warrant their use commercially.

In the second experiment the procedure was modified somewhat by packing the shrimp in stainless steel baskets (4x4½x5 inches). Into each basket was placed 1¼ to 1½ pounds of headed, thoroughly washed shrimp. This resulted in a layer of shrimp 3½ to 4 inches in thickness. Sixteen baskets (two layers of eight baskets each) were packed in commercial ice and 1000 p.p.m. sodium bisulfite ice. One basket was removed each day and the number and intensity of the black spots were observed. The shrimp used were brown shrimp *(Penaeus aztecus)* mixed with a few white shrimp *(Penaeus setiferus.)*

The results of this experiment are shown in Figures 2 and 3. Figure 2 shows the percentage of shrimp having black spots of all degrees and intensity, during the 15 day storage period. It can be seen that the sodium bisulfite greatly retarded black spot formation. Figure 3 is a breakdown as to severity of the black spots that were formed in the shrimp during storage. When the black spots are classified as to: 1.—barely detectable, 2.—very noticeable, and 3.—severe, it was noted that in each instance the sulfite showed some degree of protection against melanin formation. There was an appreciable difference between the quality of the shrimp stored under pure ice and those stored under sulfite ice; not only were the black spots less severe in the sulfite treated shrimp but in general, they also had a better appearance, were firmer, and had less odor.

The ice containing 1000 p.p.m. sodium bisulfite did not preserve the shrimp as well nor prevent black spot development to as great an extent as did the 2500 p.p.m. sodium bisulfite ice reported previously (Bailey and Fieger, 1954) (Figure 4), but the sulfite content of the former shrimp was considerably less than that of shrimp packed in the latter ice, (Table 2). Shrimp packed in 1000 p.p.m. ice for various periods still contained small quantities of sulfite even after washing or cooking, but washing and cooking by a procedure similar to that employed by shrimp canners removed virtually all of the sulfite present After these shrimp had been cooked and canned (dry packed) there was 0.8 mg. of sulfite in 100 grams of the shrimp. The sulfite content of the shrimp was also decreased by canning in six per cent brine.

Discussion:

Sodium bisulfite when used at optimum concentration in storage ices affords good protection against melanin formation on shrimp shell. This protection is brought about by four possible mechanisms: First, it sequesters some of the cupric ions associated with the enzyme tyrosinase; second, it reduces the number of microorganisms on the shrimp surface, thereby decreasing protein breakdown; third, it prevents oxidation of tyrosine and dihydroxyphenyl alanine by acting as an anti-oxidant; and fourth, it reduces some of the oxidized products, thus delaying melanin formation. It is very economical when used in

ice at a concentration of 1000 p.p.m., and practically all residual sulfite can be removed by commercial processing of the shrimp. Although higher concentrations of sodium bisulfite depress melanin formation for longer periods of time, there are several disadvantages in using this chemical in storage ices. Present commercial processes for manufacturing ice may result in localized highly concentrated sulfite, and such areas when left in contact with shrimp tissue for long periods of time cause it to change to an opaque white. These areas turn light brown when cooked and are much tougher than normal cooked tissue. The sulfite in such areas on shrimp is readily detectable by individuals sensitive to it.

Ascorbic acid also functions as an anti-oxidant and the citric acid lowers the pH, so both of these chemicals have a synergic effect in slowing down the formation of melanin.

Lemon juice preserves shrimp quite well at relatively high concentrations and also depresses black spot formation, but at the present time is too costly at optimum levels of concentration for use in commercial storage ices. A ton of ice containing lemon juice of 1/50 normal strength would cost $4.75 to $5.00 more than commercial ice. The ascorbic acid-citric acid mixture when used at 1000 p.p.m. concentration in ice would increase the cost by $2.65 per ton, while sodium bisulfite at the same concentration would increase the cost about $0.50 per ton.

Summary:

The inhibiting effects of various substances on shrimp melanosis was studied. Several different chemicals when used in this regard as dips for shrimp tails prior to their ice storage in aluminum containers were rated in the following order: single strength lemon juice: 0.1 percent sodium bisulfite; 0.1 percent ascorbic acid; 0.1 percent sodium sulfite; 0.1 percent ascorbic acid-citric acid (8-92) mixture; 0.1 percent citric acid; and finally 0.1 percent tartaric acid.

Further studies on the inhibitory effects of lemon juice and sodium bisulfite

TABLE 2

SULFITE CONTENT OF SHRIMP STORED FOR VARIOUS PERIODS IN 0.1% SODIUM BISULFITE ICE

Days of Storage	Treatment	Sulfite (mg/100 gm. shrimp)
10	Cooked Tap Water Peeled	3.4
10	Shelled: Washed (Uncooked)	2.4
10	Shelled: Cooked in 6% Brine	2.8
13	Shelled: Cooked in 6% Brine	8.1
16	Peeled: Washed: Blanched in 6% Brine (Dry Packed)	0.8

revealed that the former retarded melanin formation on shrimp shells in the presence of 96 p.p.m. dihydroxyphenylalanine for 120 hours, when used in concentrations as low as 0.2 percent of normal strength. The latter substance, when similarly tested, protected the shells perfectly when used in concentrations as low as 125 p.p.m. Seventy-five p.p.m. sodium bisulfite protected the shells from melanin formation almost as well as did the 0.2 percent normal strength lemon juice.

Melanosis retardation effects of various chemical ices were also studied by comparing shrimp stored in these ices with those stored in commercial ice. These ices, in order of the degree of protection against melanosis are as follows: 1000 p.p.m. sodium bisulfite ice; 1000 p.p.m. ascorbic acid-citric acid (8-92) mixture ice; and 100 p.p.m. sodium bisulfite ice. All three chemical ices showed some degree of protection against melanosis and resulted in shrimp of firmer texture, better appearance and less off odors than those stored in commercial ice.

Peeling, thorough washing and cooking reduces the sulfite content of shrimp packed with 1000 p.p.m. sodium bisulfite ice to practically negligible levels.

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Más Experimentos Sobre el Control de la "Melanosis" o "Mancha Negra" en los Camarones

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Abstracto

Se hicieron estudios sobre varias substancias químicas en solución, en forma de immersiones y hielos de varias concentraciones, para determinar su valor en la prevención del desarrollo de la "mancha negra" en los camarones. Se discute el mecanismo de la acción de estas substancias. También se discuten las ventajas y desventajas, tanto como los problemas económicos relacionados con el uso de las dichas substancias.

Maintenance of Quality of Sea Food Products During Transportation

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No industry is more dependent upon the maintenance of quality than the seafood industry, and the maintenance of quality during transportation is of paramount importance. The condition of the product on arrival at the destination is of real concern, as is the transportation charge. The economic importance of reasonable transportation charges cannot be questioned, since these charges account for a major portion of distribution costs. The fisheries industry should remember that it cannot escape the problems of distribution; inefficient distribution reduces net returns to fishermen and to merchandisers of fishery products.

The Department of Agriculture's interest in transportation was initiated by a directive contained in the Agricultural Marketing Act of 1946, in which, for transportation purposes, the term agricultural products includes fish, shellfish and their products. Distribution costs often determine whether a profit or loss is realized in the marketing of fishery products. With the dominating importance of this subject thus identified, an open-minded appraisal of a few objective facts in the current transportation picture will be presented.

It is some comfort to state that during the past twelve months railroad rates, generally speaking, have undergone no upward revision. In a few instances, rates have been reduced for competitive reasons. With the support of the Department rates on canned fishery products, both western and eastern, were reduced as much as 13 cents per 100 pounds, on February 4, 1954. This is the first respite in over eight years.

This situation, however, did not include the railroads' offspring, the Railway Express Agency, because a little over a year ago the Interstate Commerce Commission in Ex Parte 185, permitted an over-all increase of 15 per cent in all express rates. The agency's petition requested approximately 23½ per cent increase. The United States Department of Agriculture opposed this increase and all other increased rates and charges.

Since 1946 there has been an increase of approximately 121 per cent in express rates. In addition, other increases have resulted from cancellation of numerous commodity rates and the substitution of higher class rate schedules. Included were charges for icing l. c. l. (less than carload) shipments in transit. There is now pending before the I. C. C. Docket No. 31342, which is litigation designed to increase rail refrigeration charges by approximately 30 per cent on all carload shipments of perishables. Carload shippers of fish have a valid reason for registering vigorous opposition to this attempt to increase charges. The Department, along with most perishable products' trade associations, has intervened, and is preparing, at considerable expense, extensive testimony in rebuttal to the railroad's petition.

There is always considerable agitation with respect to trucking operations. These carriers are continuously attempting to make their services more flexible and to expand their operations. Competing forms of transport usually

appear as opponents. This makes for considerable litigation before the transportation regulatory agencies.

The I. C. C. recently notified users of exempt trucks for interstate shipments that they are prohibited from shipping pre-cooked breaded fishsticks as an exempt commodity under the provisions of Section 203(b) of the Act. Similar warnings have also been received by shippers of breaded shrimp. It appears likely that this issue will be subject to adjudication before the I. C. C. and the courts.

The railroads often refer enviously to the selectivity of tonnage handled by motor carriers. Unwittingly, perhaps, the railroads themselves have also become selective. Higher freight rates have resulted in loss to the railroads of over four million carloads of freight during the last year. Many fishery shippers have registered complaints that common motor carriers are reluctant to haul fishery products even in truckload quantities. They do not have equipment available at time shipment is offered or they simply do not show up at the shippers' loading dock.

One type of operation by which a limited number of trucking companies and railroads are combining their services for public use is the so-called "piggyback" operation. This consists of moving on railroad flat cars both loaded and empty motor truck trailers, thereby uniting two important types of carriers in a joint enterprise. One of the newest transportation advances is covered by application of the McLean Trucking Company for control of a water carrier, the S. C. Loveland Company. The objective is to create a combined sea-land transportation service by using specially designed vessels to transport truck trailers.

Of all modes of transport used in the distribution of fishery products, the Railway Express Agency was at one time the most important to the average dealer. As a good part of the fisheries trade continues to use express facilities, the industry is quite sensitive to changes in express rates and services.

Of current and utmost importance is the question of containers for the shipping of less-than-carload shipments. Effective September 1 of this year, the Railway Express Agency, despite protests made to the Interstate Commerce Commission by the United States Department of Agriculture and many members of the fisheries industry, no longer obligates itself to furnish Church containers. Oyster shippers in particular are dissatisfied that the Agency no longer supplies Church containers. Predictions were made that the answer to these shippers' problems was the transition to exempt refrigerated motor trucks transport and the use of throw-away containers. The fisheries trade must make a decision whether to use insulated containers or throw-away containers. Perhaps the greatest guarantee of maintaining quality during transportation of l.c.l. shipments would be the use of the standard refrigerated containers. Following a survey, it appears that the trade in general would prefer the Railway Express Agency to supply refrigerated containers for l.c.l shipments. Such a prospect, however, does not appear too bright. Some shippers have been using small refrigerated containers of their own to effect shipments. These seem to be satisfactory from a quality and cost standpoint. The greatest potential shipping problem now facing the fisheries trade comes with the prospect of the increasing use of throw-away containers. Their use for short distances, provided the time in transit is normal, is no problem but if re-icing is required in transit there is a definite danger that the Express Agency will not follow shippers instructions.

Information from official transportation records of loss and damage claims covering fishery products are generally unavailable and letters addressed to carriers and to some of the more important fishery organizations have resulted in little tangible data.

The following points, if heeded, would assist in preservation of quality of seafood products during transportation.

1. Shippers should inspect all transportation equipment in which their merchandise is to be shipped.
2. Truck equipment should be supplied with floor racks and lading should be placed to permit air circulation throughout the load.
3. Mechanical refrigeration should be checked to assure proper refrigeration of the entire load. Dry ice should be used as a supplement if necessary.
4. Equipment should be pre-cooled. If water ice is used drains should be checked for stoppage and plugs for fit in the ice bunkers.
5. Refrigerator cars should be pre-cooled at least 24 hours during warm or hot weather.
6. Ice and salt should be used liberally during warm or hot weather. A few extra dollars for ice and salt may safeguard against partial defrosting or complete spoilage.
7. The icing stations en route to destination should be checked to insure re-icing every 12 to 16 hours, at least during hot weather.
8. Avoid circuitous routings.
9. Trucks are susceptible to a tremendous amount of heat over the highways during hot weather. Check for unreasonable layovers on long haul shipments.
10. The shipper is generally held responsible for condition of merchandise on arrival at destination. An ounce of prevention will save claims and a disappointed customer.

There is a need for transit quality control tests of shipments of fishery products in the various types of railroads and truck refrigeration equipment. A study could be made at the same time to list the types of equipment, thickness of insulation, cartons and other types of packages and l.c.l. containers. The United States Department of Agriculture is constantly making shipping tests with fruits, vegetables, dairy, poultry, frozen fruit juices, fresh meats and other products via truck and railroads.

There is, however, no provision by which the Department can make similar surveys on fishery products. Perhaps it is consistent here to recommend that efforts be made to have similar tests on fishery products.

One large shipper of fishery products had the following to say: "I must confess I do not know the effect of present day refrigerated transportation methods on seafood qaulity. If fluctuations in temperature in transit ranging anywhere from zero to +25 degrees are considered together with the length of haul, and transfers and rehandling, considerable product deterioration is possible. A consistent temperature of zero degrees or below in transit would be ideal and, perhaps, the mechanically refrigerated rail car with its cold-hold apparatus, comes closest to this ideal.

Other shipper said: "We do have considerable trouble in shipping our

frozen fish, both by truck and rail, especially during the summer months. We get considerable defreezing in transit. High express rates are forcing the shift to truck facilities".

When goods are delivered to a common carrier for transportation, they pass from the control of the shipper during transit. The shipper cannot determine what may be happening to his property and must rely entirely on the carrier for safe transport to the designated consignee. In all instances a shipper must get a "clear" bill of lading to show that shipping documents have no notations such as damaged containers or other impairment.

The U. S. Supreme Court has ruled that a claimant is entitled to full, actual loss caused by breach of the transportation contract by the carrier. However, the carrier is not responsible for an act of God, a public enemy, any adverse act of the shipper, or the inherent nature of the goods. He is responsible for any and all causes which do not generally fall within the purview of these exceptions.

The Interstate Commerce Commission has no jurisdiction over loss and damage claims. Such claims must be decided in the courts. However, the Interstate Commerce Act does place certain responsibility upon the carrier. An excerpt from Section 20 of the Interstate Commerce Act asserts that the common carrier shall be liable to the lawful holder of the bill of lading for any loss, damage, or injury to the property covered by that document.

From a practical standpoint the fisheries industry is concerned with getting its products to market safely, in merchantable condition, and at a price the consumer can afford to pay. At the present time inadequate shipping facilities, combined with high transportation costs are the major obstacle in the path of attaining this goal.

Mantenimiento de la Calidad de Mariscos Durante su Transporte

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Abstracto

El éxito en el comercio de los mariscos depende grandemente en el costo de la distribución y en el mantenimiento de la calidad de éstos durante su tránsito. De todos los medios de transporte de productos pesqueros, el ferrocarril y los camiones son los más importantes para el distribuidor corriente. Los precios del transporte de productos pesqueros entre los diferentes estados so controlados por la I.C.C. Vehículos refrigerados ofrecen un servicio más flexible.

De importancia actual es el asunto de los envases para lotes pequeños. El comercio pesquero debe decidir entre el uso de envases aislados, o envases que se puedan descartar después de ser usados. Para proteger la calidad durante el transporte, el fletador debería inspeccionar el vehículo, insistir en el preenfriamiento y envío directo.

Immersion Freezing of Shrimp Aboard the Fishing Vessel

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For some time the firm of Mingledorff's Inc., has carried on, under the direction of Mr. W. H. Carpenter, a research program to develop a system suitable for holding shrimp on large shrimp trawlers. The approach has been parallel to that of the University of Miami in that we first developed a system for holding shrimp in refrigerated sea water. This system was satisfactory for a trip of 14 days or less but did not solve the problem for a large boat that made longer trips. We tried many things to prolong the 14 day period and met with some success, but basically raw shrimp after seven days, regardless of how they are handled, lose quality.

In the work with refrigerated sea water it was found that if the water was cooled below 32° the shrimp froze. By increasing the concentration of salt the temperature was lowered. The freezing was good but it was found that when the shrimp were held in storage the salt crystallized and the shrimp dehydrated. Glazing the shrimp did not help, since the salt made the glaze unsatisfactory, and furthermore, glazing aboard a vessel at sea would not be desirable.

We next experimented with a solution of sugar and salt with which the Fish and Wildlife Service had done some work. We found that it worked well for certain definite mixtures. Some salts were satisfactory and others were not; the same applied to various sugars. We finally perfected the solution to the extent that we could freeze shrimp at 0° to 5°F. in fifteen minutes or less, depending on the amount of agitation of the solution.

We next experimented with the holding qualities of these shrimp. It was found that shrimp frozen in this solution would not stick together, and remained separated during 60 days of storage in a large freezer room, when left in an open card-board master carton. Furthermore, there were no visual signs of dehydration. Shrimp when thawed out after 60 days in open storage looked as though they had just come from the water. A sample iced for seven days kept as well as fresh shrimp.

Repeated freezing of the same shrimp was attempted. Shrimp frozen as many as five times were still firm and had no tendency to separate from the shell.

From this knowledge we proceeded to apply the system to a conventional vessel. Mr. Henry Ambos of the Trade Winds Corporation allowed the first installation on his vessel, the *Miss Trade Winds*. From experience gained on the *Miss Trade Winds* we were able to simplify the installation of the next unit, which was installed on the *Prince Charming*, a vessel owned by John Fazio Shrimp Company and operated under the supervision of Tommy Fazio of Tampa, Florida.

The system as installed on the *Prince Charming* includes a freezing tank on deck. This tank, including insulation, is approximately 4'6" wide, 7'10" long and 4' high. It is of stainless steel on the inside and contains the freezing plates and solution. It is also equipped with a hydraulically driven propeller which circulates the solution through the plates and then through the shrimp. The refrigeration is supplied by a diesel-driven unit which can be located

anywhere space is available. The latter is approximately 6'4" long, 2' wide and 4'10" high. The cargo hold is converted to a frozen storage room by use of plates and another diesel driven unit slightly smaller than the freezing unit.

The procedure used on the boat is as follows: After a drag is completed the shrimp are headed and thoroughly washed. The shrimp may then be weighed in 50 pound lots and dumped into special stainless steel wire baskets which are designed with a patented closing feature. The basket is then placed in the tank in guides that hold it in place. The shrimp immediately freeze, and if the basket is raised the shrimp fall apart and completely fill the basket. This gives space for the solution to pass readily through the shrimp. After 15 minutes the shrimp are completely frozen. Whenever it is convenient the baskets are picked up and tipped to drain. It is important to get the shrimp into the holding room as soon as possible after freezing. The shrimp are now dumped into baskets and placed in the storage room. On the *Prince Charming* the entire cargo hold had been converted to 0°F storage space, overhead plates supplying the refrigeration. At the end of the day, or at the crews' convenience, the shrimp in the baskets are dumped into 50 pound master cartons. A wooden grating installed on the floor and sides of the holding room allow circulation of the cold air completely around the cartons. The cartons are stacked as closely together as possible, starting at the outside and working to the center. Once the shrimp are placed in the cartons there is no further necessity to handle them until they are unloaded.

It is useful to compare this with the more conventional systems on freezer boats. These systems vary a great deal but the basic procedure is similar. Since the process of freezing is much longer it is not practical to freeze during the dragging, so the shrimp are held in a tank on deck until the end of the fishing. The shrimp are removed from the tank as they are processed. First, five pound cartons are assembled and the shrimp are placed in them and weighed. Next, the five pound cartons of shrimp are placed on the freezer plates. Since the shrimp are in a box and the only contact with the plate is from the bottom the shrimp slowly freeze from the bottom up. The lower shrimp freezing first tend to insulate the carton, and the top shrimp freeze very slowly, the freezing time varying from 8 to 14 hours. These shrimp cannot be held any length of time without glazing, therefore, on the better boats extra fresh water is carried and each carton is opened, water poured in, and the cartons are again placed on the plates and refrozen. The five pound cartons are now removed from the plates and packed in 50 pound master cartons. In the immersion freezer system practically no time is spent by the crew in the refrigerated space. On the other system hours must be spent actually in the freezer space, which of a necessity must be at a lower temperature than a storage room.

A large consumer of frozen shrimp is the breader or other processor. A processor receiving frozen shrimp in five pound cartons has to tear off the carton and put the shrimp in a tank of water, usually overnight, to thaw them. The outside shrimp thaw during the night while the inside are still in a block of ice. Immersion frozen shrimp thaw faster, because when the 50 pound carton is dumped the shrimp immediately separate and in 30 minutes are completely thawed. In retail markets immersion-frozen shrimp are kept in the freezer in 50 pound cartons. If the operator needs 25 pounds

he can take them from the carton, wash them and put them on the counter as raw shrimp. They are far superior in appearance and quality to shrimp brought which have been stored in ice.

Or consider the large hotel or restaurant chefs. If they have shrimp in five pound cartons, they have to anticipate their consumption accurately, because of the length of time necessary to thaw the shrimp. With individually frozen shrimp they can take out a small number and it is easy to get more during the day. Another advantage is that the shrimp can be repackaged as frozen shrimp in the merchandisers own package, without thawing them.

Quality is of the first importance in frozen food and shrimp frozen as soon as possible after they are caught are the best quality. Experts have told us that they can identify frozen shrimp from fresh shrimp, but we have seen them fail with shrimp frozen by our system. For example, immersion-frozen shrimp are not dessicated in the tail region as are many frozen shrimp. Pink shrimp, when they are first caught, have a bright pink spot on the side. During ice storage this disappears. On immersion-frozen shrimp the pink spot returns after the shrimp are thawed.

Finally, is the important fact that the refrigeration can be operated above a vacuum, because of the higher freezing temperatures, eliminating a lot of difficulties normally experienced. With two separate systems, should something happen to the holding room unit, the freezing unit can be operated to hold the storage room. We have avoided the use of electrical controls or electrical motors.

On the first trip of the *Prince Charming* Mr. Fazio brought several of his other boats fishing in the area to the *Prince Charming* and using extra help of the vessel being unloaded processed 3380 pounds of shrimp in 11 hours. This kind of volume is impossible on the conventional freezer boat.

It is our feeling that the immersion type of freezing using the solution giving the protective coating is the answer that the shrimp industry has been looking forward to. We have a quality product, rugged equipment at a comparatively low cost.

La Aplicación Práctica de Congelamiento por Medio de Immersión a Bordo de un Bote de Red de Arrastre

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Abstracto

Este manuscrito describe un congelador de tipo de bodega de immersión para congelar camarones en alta mar.

El sistema consiste de un tanque sobre cubierta que contiene una solución congelante de sal y azúcar. Un motor diesel, de refrigeración, distribuye el refrigerante a través del tanque refrigerador; la bodega que está aislada, es mantenida a 0°F por medio de una unidad de refrigeración separada.

50 libras de camarones descabezados son colocados en cestas de alambre especial de acero inoxidable. Después de 15 minutos de immersión en la

solución congelante, los camarones quedan sólidamente congelados, siendo después almacenados en cartones de 50 libras, en la bodega refrigerada. Experiencia práctica con este equipo a bordo de botes pesqueras comerciales, demuestra un ahorro en fuerza manual, así como mejor calidad y más facilidad en el manejo del producto congelado.

Fish Oils and Proteins: Their Contributions to the World's Feed Supply

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In the United States the total supplies of high protein feeds for 1953-54 and 1954-55 are estimated at a little more than 13 million tons. Of these totals, fish meal represents slightly more than 2.6 percent, but if expressed in terms of oilseed equivalent the figure would be 3.6 percent. Admittedly, these appear to be insignificant parts of the whole, but without this ingredient, with its multiple values, it is highly probable that we would not have been able to achieve the extraordinary improvements in feed conversions, especially in broiler and turkey starters, which we have witnessed since 1946. For instance, in these eight short years there has been a 28 percent improvement in feed conversion so it is now possible to raise broilers at a rate of one pound of meat for each 2½ pounds of feed. Similar, though less spectacular, gains are seen in other livestock growth trends. This is one major reason why apparent civilian consumption of eggs is up 39 per cent, chickens 85 per cent, and turkeys 114 per cent in 1954 by comparison with 1935-39 averages.

Fish meal of good quality provides more of the essential amino acids, which are most likely to be of dubious availability or short of requirements when vegetable sources are relied upon, than any other protein ingredient. Three of these—lysine, methionine, and tryptophane—show to particular advantage in fish meal. In fact, fish meal normally contains twice as much, or more, of the first two and fifty per cent, or more, of tryptophane than any of the commonly-used vegetable protein products which make up nearly 80 per cent of all high-protein supplies.

In addition to its peculiar amino acid qualities and highly available protein there are present in fish meal abundant supplies of B-complex vitamins, especially vitamin B_{12}, phosphorus and trace elements, the unknown "fish factor(s)", in some cases vitamin A and D, and energy in the form of fat. Much has been said and written of their value over the years and it is now acknowledged that these fish products are difficult to replace in our modern complex feeding program. Few products have ever been studied as intensively as fish meal and fish solubles have been in the past five years. If it were not for the recognized factors, known and unknown, which these products contribute to feeds, efforts would not have been expended to isolate and produce them synthetically, by fermentation, or otherwise. Undoubtedly the time is not distant when the unknowns will become knowns, but the fish products

need never again be sold purely on the merits of protein evaluations. Fish meal is a natural concentrate of exceptional worth, and, as we learn more of its components and their inter-relationships with the factors in all other feed ingredients, there is every reason to believe that this product will continue as a key to most efficient nutrition. This is one reason why we are determined to develop a quick chemical method of assay for protein evaluation. This is a critical need of processor and consumer alike and it is difficult to achieve, as shown by the limited success realized on similar soybean meal projects which have been in progress for a number of years. Surely a product which can have such an impact on our entire agricultural and food economies should have priority to proceed with this vital research program.

Fish meal has been discussed first because of its top rank as a protein feed ingredient. Another product of the fisheries, which has played a leading role in animal and poultry nutrition, is condensed fish solubles. This material is not generally looked upon as a protein ingredient because it usually contains less than half as much by volume as fish meal, it is commonly used at rather low levels in feeds, and its protein is not as readily available as that of fish meal. In fact, as a provider of lysine, methionine, and tryptophane, condensed fish solubles is only one third as useful as fish meal; however, it is a substantial contributor to nutrition because of its exceptional content of vitamins, notably those of the B-complex, and the unknown fish factor(s). That it is also the richest natural source of vitamin B^{12} is common knowledge.

Comments on so-called "whole" or "full" meal are warranted because of the widespread use of these names and the frequent questions we receive concerning their meanings. A study is currently being made of proper designations for fish meal to which fish solubles have been added, and fish meals which have been processed without removal of stickwater. Clearly, feed control officials must have reasonable definitions and workable methods of determining the presence of guaranteed values. This problem is complicated by the numerous species of fish which are utilized throughout the world and by whether they are reduced from the round state or from cuttings of edible fish. Other contributing difficulties are: (1) blends of several varieties of raw materials; (2) seasons during which fish are caught; and (3) processing techniques. An excellent treatise of this subject by C. F. Lee appeared in the September issue of *"Commercial Fisheries Review"* under the title, "Technical Note No. 30—Proposed Method for Estimating Amount of Solubles Added to Whole Fish Meal". This is a problem not easy of solution and there are many who do not feel that it is important since they consider fish meal and solubles to be too valuable to place in a single package. If neither is to be wasted they should be used on the basis of their individual merits, fish meal primarily as a high protein supplement and solubles for its special vitamin and fish factor(s) values. It should not be overlooked, however, that research may develop new values for solubles or show us how to recover values presently being lost.

Fats and oils have been used as feed and food since the times of our earliest knowledge. Fish oils were used in earlier times without comprehension of what they contributed. It was known that growth was promoted and that was the principal need. It is now realized energy is also provided and that the oils frequently carry the fat-soluble vitamins. Now one hears constantly about improvements made possible in feeds by the addition of fat. Almost without

exception research has shown greater feed efficiencies with broilers, layers and swine when fats have been added to rations of the high-energy type so popular since the beginning of World War II. A practical maximum of vegetable energy from corn has probably been reached. It is known that, with the increase of the energy factor, higher levels of essential nutrients, such as proteins and vitamins, are required because of the lowered feed intake. Soybean meal has become the principal protein source, and another problem has thus been introduced. It is only possible to produce soybean meal with a protein level of 50-52 percent by the extraction process, but to achieve this point the oil level is necessarily reduced, making it difficult to hold the desired energy.

Good quality fish meal of average nutritive value provides the one opportunity for building up protein and, simultaneously, adding energy through its oil content. Even this oil, when fish meal is fed at practical levels, cannot provide the required energy for the ultra high-energy feeds of the future, so feeds undoubtedly will be augmented by supplemental oil and fat.

It is not impossible that, in spite of the record soybean crop of approximately 330 million bushels in the United States during 1954, there may be a shortage of protein feeds in the present crop year 1954-55. Only the release of government-held stocks of cottonseed meal and dried milk solids prevented chaotic conditions during the past summer. This was evidenced by violent fluctuations in soybean prices with every change in predictions of the new crop as the weather varied from dry heat to showers. To feed the poultry and animals currently on our farms at optimum protein levels, it is reliably stated that we need a soybean crop of 500 million bushels—an increase of 50 percent over this year's record. Scientists warn us that we cannot assume that necessity is the mother of invention, particularly when weather plays such a large part. A survey of the soybean acreage in the United States shows that 85 percent of the 1953 and 1954 crops came from the six states of Minnesota, Iowa, Missouri, Illinois, Indiana and Ohio. Is it not clear that, if crops are to be raised to supply anything like the ideal volume of protein for poultry and livestock feeds required to build food for 25 percent more people in 1975, all our scientific and management acumen must be put to full use?

It is believed that average protein use per animal unit is higher in the United States than elsewhere, but there is no reason why, if given the opportunity for development, there should not be enormous expansion of soybean plantings in many lands. This one item undoubtedly will be the base protein for many years to come.

Other countries, notably Norway, Iceland, the United Kingdom, and Japan, which are more dependent on the sea, will put still greater effort into effective utilization of marine products. There are riches in the sea which have hardly been tapped and the over-all future of this immense resource which covers more than half the globe yet supplies only 1 percent of the foods its peoples consume must be considered. Fishery resources have been seriously depleted in places because of carelessness or plain lack of knowledge. This ignorance must not continue as the demand for sea products mounts rapidly with our population. The folly of delayed or insufficient research is too clearly depicted by enormous economic losses in such fisheries as the California sardine and the Maine herring. On the opposite side of the ledger are certain fish about which enough has been learned that, by intelligent regulation and cooperation, frequently international in scope, the fisheries have been re-

covered in spectacular manner. Among these are the haddock in the Atlantic and the halibut of the north Pacific.

Also, progress is being made in the Alaskan herring and west coast salmon fisheries, and a start has been made on the Maine herring problem. Studies on the California pilchard have been carried out for many years, but on a totally inadequate basis. A similar disappearance of sardines may be occurring in South Africa and Angola, an area where international cooperation will be essential if there is only one stock.

In general, practically nothing is known about most of our commercially important fish. This is especially true of those species which contribute most heavily and directly to our world feed supplies—the menhaden, pilchard, and herring. If we are to maintain or expand the essential supplies of those products which are so needed to balance high-efficiency feeds, in order that we may produce high-protein foods, industry and government must work together on their comprehensive research programs. Only then will this great resource, the sea, be fully exploited, and with wisdom born of knowledge.

Aceites de Pescado y Proteínas: Su Contribución al Abastecimiento de Forrajes del Mundo

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Abstracto

La harina de pescado representa unicamente 3.6 por ciento de los forrajes proteínicos producidos en los Estados Unidos; pero la dicha harina es mucho más importante de lo que estas cifras indican.

Esta harina ha ayudado con sus varios suplementos, a mejorar la industria de las aves de corral.

Una de las necesidades más grandes de esta industria es el desarrollo de un método químico rápido para la evaluación de las proteínas.

A pesar de una cosecha record de frijol soya, este país puede tener que hacer frente a una merma de forrajes proteínicos el proximo año. Bien puede ser que el mar pruebe ser una fuente de alimentos proteínicos.

Investigaciones científicas son necesarias para proteger y desarrollar estas fuentes.

Recent Explorations for Yellowfin in the Gulf of Mexico

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Prior to the inception of the Gulf Exploratory Fishing Program in 1950, the meager information available on tuna in the Gulf gave little indication of the presence of commercially valuable stocks. The occasional captures of blackfin tuna *(Thunnus atlanticus)* and the infrequent observations of schools of this species constituted the sum of our knowledge. The incidental sport-trolling capture of white skipjack *(Katsuwonus pelamis)* sparked few imaginations. It was a species of known cosmopolitan distribution in warm seas, something to be expected, but of no local commercial importance. The known range of Atlantic yellowfin tuna *(Thunnus argentivittatus)* extended through the tropical and subtropical Atlantic and Caribbean. It could have been assumed that this species extended into the Gulf of Mexico, seasonally at least, as was indicated by its widespread distribution, but there were no published records of its capture or observed occurrence in that area. So when the exploratory investigation of the possibilities of a Gulf of Mexico tuna fishery was incorporated in the Gulf Program, it was given secondary priority.

In 1950 and 1951 activities were devoted primarily to exploratory shrimp fishing along the continental shelf. During this period a tuna log was maintained, and all surface signs of fish and trolling captures were noted. It was hoped that eventually a summary of these notes would suggest the methods and gear most useful in exploration. This running account of observations was spectacularly climaxed in the late summer of 1951. On the morning of August 29, at a position approximately midway between the Campeche Banks and the Mississippi Delta, small, wild schools of yellowfin tuna were sighted. The schools were under constant observation throughout the day, as the *Oregon* ran north. Several of these schools responded to the spray of the fire-hose (a method used in the Asiatic tuna fisheries to attract fish) and came to the vessel. These fish appeared to range between 30 and 70 pounds in weight, with an average of about 60 pounds; however, none were taken on trolling lines. Two weeks later, while trawling for red shrimp off the Mississippi and Louisiana coasts along the 200-fathom curve, nine schools of blackfin tuna, with estimated sizes of 100 to 500 tons per school, were seen during one day. Thus, within two weeks we had observed two different species, both present in large numbers, and both suggesting a different type of exploratory approach.

It was essentially from these two observations, supplemented by numerous less spectacular records, that our present two-phase exploratory tuna program evolved. Phase I, instigated in 1952 and to be completed in 1955 has two principal objectives: to determine which species are present in commercial concentrations, and to determine the best gear and fishing techniques for commercial production. To achieve these objectives Phase I was designed to devote one year of fishing effort to each of the three major commercial tuna fishing methods, purse seining, live-bait fishing, and long-lining, in that order.

Phase II was to be dependent on the previous results, with the basic objective to be a concentrated year-round application of the gear found to be most successful during Phase I.

During the 1952 meetings of the Gulf and Caribbean Fisheries Institute, Stewart Springer, Chief of the Gulf project, presented a report on the problems of tuna exploitation in the Gulf and Caribbean area. In his paper he summarized the results of the first year's work on purse seining. During the summer months of 1952 many small schools of blackfin tuna and white skipjack were sighted. However, all the schools were loosely grouped, fast moving, and were found in clear water. This combination of unfavorable factors proved to be insuperable, and no successful sets were made. Cruise 18, the following winter, was spent investigating the availability of live bait in the Gulf and methods of bait capture. Quantities of *Jenkensia lamprotaenia,* and *Sardinella anchovia,* two bait species used in the local Cuban tuna fishery, were found in large numbers on the Campeche Banks, along the Florida west coast, and in the Florida Keys. Also, two species of anchovies were found in quantities around the islands off Alabama and Mississippi. Baiting operations by the *Oregon* throughout 1953, using the trap lift net described by Siebenaler (1953), demonstrated a readily available bait supply in the Gulf.

Cruises 19 and 20, spanning the period of April to October, 1953, were devoted to live-bait and pole and line fishing in the eastern Gulf. In general, fewer tuna were sighted during this period than in any of the three preceding summers. However, contact was made with several small schools of mixed white skipjack and blackfin tuna from the Mississippi Delta to the Florida Straits, permitting several trials of live bait fishing for these species. Small numbers of fish were taken from several schools but few could be held at the stern long enough for satisfactory catches. The largest catch from any one school was 28 fish, mixed blackfins and white skipjack. Most distracting was the occasional occurrence of four-pole yellowfin tuna under the five to 15 pound fish. They accounted for several lost rigs. None appeared when heavy gear was overboard and none were captured during the live bait operations. However, of interest and possible significance was the capture of several small bluefin tuna *(Thunnus thynnus)* from a school of mixed species off the Louisiana coast—our only record of this species in the Gulf.

Phase I has been concluded this year with the completion of five successful long-lining trips. (Long-line gear has been extensively discussed in several Fish and Wildlife Service publications. Niska, Murray, and Shapiro describe and illustrate several of the infinite varieties of this gear employed in different tuna fishing areas of the world.)

Cruise 23 to the western Gulf of Mexico and the Gulf of Campeche during May and June yielded yellowfin tuna at 14 out of 20 long-line stations fished, for a total catch of 37 yellowfin tuna with an average weight of 118 pounds. Cruise 24 in the northeastern Gulf in July produced 112 yellowfin averaging 99 pounds each. Cruise 25 in August in the north-central Gulf caught 146 large yellowfin. And, in late September and early October, on an 11-set east-west transect at one degree intervals through the central Gulf, 102 large yellowfin were caught. The total catch for these four trips amounted to some 43,000 pounds of yellowfin. As a product of exploratory fishing this catch leaves little question of commercial possibilities.

Test packs of these first catches have been made at four commercial canneries and at the Service's Technological Laboratory at College Park. Reports received to date indicate that these Gulf-caught yellowfin are of better quality in regard to color, texture, and yield than are the yellowfin caught

in the principal fishing grounds off the Galapagos and Peru, or those imported from Japan.

There are a few aspects of that figure of 43,000 pounds that deserve mention. First, about 20 per cent of these fish were badly mutilated by shark bites. An additional 10 per cent were slightly scarred, but were considered satisfactory for canning. Since most of the shark damage occurred while the hooked fish was traveling the last hundred yards before being brought to gaff, several shark disposal techniques were tested. Two effective methods were chumming and shooting them, and hanging a row of baited shark hooks in the water along the stern. Caught sharks were allowed to hang along the stern until the long line was completely hauled, then fins and liver were removed. As many as 25 large white-tip sharks *(Pterolamiops longimanus)* have been taken in this manner at one station.

Second, during the first two long-line cruises, 134 gangions (leaders) were parted and the fish lost. It was estimated that approximately 90 per cent of these losses were yellowfin tuna. Broken gangions were usually found in groups adjacent to a caught tuna. On several occasions tuna were seen parting the line while the gear was being hauled in. Subsequent changes in gear reduced these losses to less than 10 per trip.

With the experience of the Service's Pacific Oceanic Fisheries Investigations to draw on, several of our major gear problems have been quickly solved. We have gradually increased the amount of gear per set until at present our "standard set" is 50 baskets, or some 45,000 feet of mainline fishing 500 hooks. This amount of gear is perhaps only half of what could be run by an experienced commercial crew.

An analysis of long line results to date, and estimates of the seasonal occurrence and distribution of yellowfin tuna in the Gulf would be premature. However, the few facts now at hand indicate commercially valuable stocks of large yellowfin tuna widely distributed beyond the edges of the continental shelf. Comparable to those of the central Pacific, these deep swimming tuna are rarely seen at the surface. The few surface observations have been of wild, rapidly moving fish in small schools, occasionally mixing with other tuna species of smaller sizes. Length and weight records of tuna captured this year show the presence of several well defined size groups. Sizes of individuals in the catch have ranged from 9 to 183 pounds with an average of approximately 110 pounds. The fish caught on the May-June cruise to the western Gulf were sexually mature, either ripe or partially spawned out. These observations and the collection of post larval and juvenile yellowfins at night-light stations throughout the Gulf conclusively show the Gulf to be at least one spawning area for this species.

Phase II, as programmed for 1955, has four objectives:

1. To learn if profitable fishing concentrations of yellowfin tuna are present in the Gulf throughout the year and locate the areas of highest catch rate.
2. To determine optimum gear depths.
3. To compare the effectiveness of several potential bait species.
4. To determine the continuity of catches and variation of catch rate between the Gulf of Mexico and the Western Caribbean.

The selection of these objectives has been influenced to a large extent by

the interest that currently exists in this new development apparent throughout the Gulf area and on the east and west coasts of the United States. In September the first commercial catch of Gulf tuna was made by the *Santo Antonino,* a west coast purse seiner converted to multi-purpose tuna fishing.

Starting out with 15 baskets of long line gear and fabricating new gear each day until some 45 baskets were being fished during the final week, 25,000 pounds of yellowfin were landed. This catch took place within 100 miles of the Mississippi Delta. At the present time there are two additional longliners working this area. Another is being rigged and should be on the grounds within the next few weeks. The success or failure of these pilot fishing ventures and finding answers to the exploratory objectives previously outlined will play an important part in determining the rate at which this potential Gulf tuna fishery will develop.

Exploraciones Recientes para Atunes de Aleta Amarilla en el Golfo de México

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Abstracto

Se presenta un resúmen de las exploraciones por atún, hechos por el Fish and Wildlife Service, en el Golfo de México en los últimos tres años. Pesca por medio de redes, cebo vivo y espineles fué llevada a cabo durante los veranos de 1952, 1953 y 1954 respectivamente. Los resultados, con redes y con carnada viva, fueron malos y no se hicieron pescas que se pueden llamar comerciales. Las pescas exploratorias hechas con espineles en 1954 han producido más de 43,000 libras de atún de aleta amarilla, y han despertado interés en el Golfo para empezar producción en pequeña escala.

Exploitation of Deep-Water Shrimp of the Gulf of Mexico

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Commercial shrimp fishing fleets of the Gulf of Mexico operate in inshore waters of fifty fathoms or less, and most of the present shrimp production comes from a relatively small portion of the area of the Gulf's broad continental shelf. Some shrimp of one or more of the commercially important species are found in all waters of the Gulf out to fifty fathoms or more, but there are large areas in which shrimp are not present in sufficient concentration to permit profitable catches. Since 1950 the U. S. Fish and Wildlife Service's exploratory fishing vessel *Oregon* has carried out a systematic search for shrimp concentrations on the Gulf continental shelf (Springer and Bullis, 1951 and 1954) which has resulted in important discoveries. This phase of

shrimp exploration of the shallower waters of the Gulf using conventional gear is now complete.

The total shrimp landings by the American fishery have increased steadily until their value exceeds that of any other fishery product of the United States. Characteristically the industry has been able to absorb increasing landings of good quality shrimp without resorting to production quotas or to devastating price cuts.

Since there has been an apparent reduction in the catch of Gulf shrimp per unit of effort during 1954, the shrimp fishing industry has shown a strong interest in the discovery of new shrimp fishing grounds. Plans for a search for new profitable areas of operation for the Gulf of Mexico shrimp fishing fleet by the *Oregon* in 1955 will emphasize exploration of deep water.

The potential fishery resources of deep waters of the Gulf of Mexico or of most open ocean are little known. However, the long-line fishery for tunas in the Pacific and the recent discovery of deep-swimming yellowfin tunas in the Gulf of Mexico (that may lead to the establishment of a tuna fishery there) are examples pointing to the importance of the offshore areas of the oceans as a source of fishery products. In the Gulf of Mexico, shrimp trawl drags by the *Oregon* have been made out to a depth of 500 fathoms. One of the surprising results was the comparatively high volume of catches from the bottom in 200 to 300 fathoms. Recent chemical studies carried out at the U. S. Fish and Wildlife Service laboratory at Galveston, Texas, on samples of water collected by the Service's biological research unit on cruises of the M/V *Alaska,* have shown the presence of significant concentrations of carbohydrates in Gulf samples taken from depths of approximately 50 to 270 fathoms. The presence of carbohydrates is theoretically associated with photosynthetic activity. This has special importance considering other findings of both the biological and exploratory units. Surface waters of the Gulf of Mexico beyond the continental shelf have been observed irregularly and infrequently. Nevertheless, there is evidence of a rich and varied fauna beyond the limits of the shelf, as shown by exploratory fishing with long-lines and trawls. The comparative scarcity of sea birds over the central Gulf of Mexico may be associated with poor supplies of suitable food at the surface. During searches by the *Oregon* for tuna in the central Gulf, flocks of feeding birds, such as Audubon's Shearwater, were found to be usually reliable indicators of the presence of tuna near the surface. However, many schools of tuna were found at the surface without accompanying birds. Furthermore, whale sharks, a form feeding on the larger plankton, have been seen at the surface only a few times, but they have been observed in numbers sufficient to suggest that the species is not rare in the Gulf, but is ordinarily down out of sight. Observations of whales in summer, both sperm whales and fin-backs, as well as the occasional appearance of large numbers of jacks and unidentified schooling fishes under night-lights over the deep water of the Gulf are inconsistent with a concept of the near-sterile sea, and point to the need for investigation of the deeper water where our knowledge of the distribution of plankton organisms basic to the food chain is inadequate.

It seems reasonable under these circumstances to give more attention to the possibilities for harvesting deep-water shrimp taken from waters beyond the 100-fathom curve.

The commercial species of shrimp of the continental shelf are caught on or near the bottom. These shrimp occasionally swim upward to the surface layers of water but the frequency of movements away from the bottom is not known. Solely on the evidence of the depth location of capture of commercial shrimp we can regard them as primarily bottom dwellers. The deep waters of the Gulf support a greater number of kinds of shrimp than the shallow waters. For convenience in this discussion we may classify the deep-water shrimps into two groups, based in part on the presence or absence of structures such as very large swimmerets apparently adapting them to mid-water life. For present commercial use large shrimp are desirable. An example of a large midwater dwelling shrimp is *Plesiopenaeus edwardsianus*. We know very little of the distribution and abundance of this form in the Gulf, and since gear for catching midwater forms is less effective in its present stage of development than gear for catching bottom dwellers, we expect to emphasize investigation of the availability of bottom-dwelling shrimp.

Hymenopenaeus robustus is a bottom-dwelling shrimp, large enough to be desirable for present markets. Concentrations of this species have been found by the *Oregon* in the 200 to 250 fathom depth range, and catches have been reported in two accounts of *Oregon* shrimp exploration work (Springer and Bullis, 1951 and 1954). This species will be a principal objective in exploratory searches by the *Oregon* in 1955.

The deep-water shrimp *Hymenopenaeus robustus* has been given the vernacular name "red shrimp" in previous reports, but it now appears that the name may not be a good one because of the probability of confusion. Some of the commercial shrimps taken on the continental shelf have occasionally been referred to as red shrimp, and although *Hymenopenaeous robustus* is more strongly colored than any of the shallow-water shrimps of the Gulf, another distinctive common name would be desirable. Furthermore, some of the other shrimps of deep water have stronger red pigmentation than *Hymenopenaeus*, so that if there is future commercial utilization of many of these shrimps, the market supply would include shrimps of many shades of red. In the case of *Hymenopenaeus* the red color appears to be advantageous. Frozen packages of these "heads-off" shrimp, whether peeled or not, are very attractive. Also, these shrimp have excellent flavor and texture, so marketing problems do not appear formidable.

The heads of *Hymenopenaeus* are large, approximately half the total weight, and it is necessary to remove the heads immediately after catching to prevent juices from the head discoloring the body. Some of the catches made by the *Oregon* have been very muddy, in spite of the long haul to the surface, but it seems likely that the accumulation of quantities of mud can be avoided with properly working gear.

Toward the shallower part of the Gulf range of the species, in depths of 200 fathoms and less, another related but smaller shrimp, *Penaeopsis megalops*, is abundant. Drags by the *Oregon* in this depth range have usually produced mixed catches of *Penaeopsis* and *Hymenopenaeus*. Both forms are excellent as food but the small size of *Penaeopsis* makes sorting desirable.

Fishing for deep-water shrimp is attended by a number of problems new to the shrimp industry. The depth range of the species is a relatively narrow band along the slope of the continental shelf. Recording depth sounders are necessary for keeping the net on the bottom at the proper depth. Only the

larger and more expensive models of the commercial depth sounders have sufficient range to cover the 200 to 300 fathom depths. Usually the 200 to 300 fathom band in the Gulf area lies more than 50 miles offshore, and accurate determination of position is desirable, if not necessary. Loran receivers provide the most convenient method of keeping on position in those areas where shore stations are in operation. But they are expensive, and comparatively few shrimp fishing vessels are equipped with them.

The dragging done by the *Oregon* up to the present time for deep-water shrimp has not been sufficient to give a basis for precise recommendations as to wire size, trawl construction, or the best wire scope. A large part of the Gulf area in the 200 to 300 fathom depth range has a soft mud bottom, so that the greatest hazard to gear comes from bogging. This difficulty has been overcome to some extent by use of a mud rope, but the use of the Weems trawl door (a door having its lower half an arc of a circle with a very wide iron shoe on the curved portion) has been most effective in reducing gear losses. In most of the exploratory drags made by the *Oregon* the trawls have been used on a bridle from a single towing warp of 3/8ths to 1/2 inch wire, with a scope of 2-1/2 to 3-1/2 times the depth. The trawl seems to work very well on a bridle provided the latter is long enough (25 fathoms or more, depending on the size of the rig), and provided the rig is properly balanced. Ordinarily, in making our drags, the wire has been streamed out at near full speed after the net has been put overboard and settles and spreads in the water. As the amount of wire paid out approaches the desired scope, the vessel has to be slowed down to a trawling speed of 2-1/2 to 3-1/2 knots to prevent sudden strains on the gear, and, of course, to maintain some tension on the wire to keep the net spread. In planning for explorations in 1955 it has been recognized that study of the operation of gear in deep water is necessary.

Summary

1. The important shrimp fishery of the Gulf of Mexico has demonstrated its long-range ability to find increasing markets and should be able to continue its development toward maximal utilization of all Gulf of Mexico shrimp stocks, including those in deep water beyond the continental shelf.

2. A combination of theoretical reasoning, based on determinations of the distribution of carbohydrates in the Gulf of Mexico and on empirical data from catches made by shrimp trawls, points to the existence of a rich shrimp fauna beyond the continental shelf edge down to depths of 270 fathoms. Exploratory drags have produced relatively large quantities of bottom-dwelling invertebrates, including shrimp, between depths of 150 and 300 fathoms. Gear limitations have prevented the accumulation of empirical data on midwater-dwelling shrimp, but the depth zone from 50 to 270 fathoms is of interest as a potential source for shrimp.

3. In earlier explorations by the *Oregon* catches of *Hymenopenaeus robustus,* a shrimp of good size and quality for marketing, have been made in promising quantity on the bottom with shrimp trawls at depths from 200 to 300 fathoms.

4. The program of operation of the exploratory fishing vessel *Oregon* in the Gulf of Mexico for 1955 emphasizes exploration for *Hymenope-*

naeus robustus, with work on the difficult problem of the development and methods of use of effective and economical gear in deep water.

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Nueva Información Sobre los Camarones Rojos en el Golfo de Méjico

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Abstracto

Se discute la importancia de las poblaciones de camarones, tanto los que están en uso ahora, como los que se encuentran en cantidades potenciales. Se resumen los resultados de dragas hechos en aguas profundas por el bajel Oregon, incluyendo el trabajo hecho cerca de Dry Tortugas, Florida, en profundidades de 200 a 300 brazas, donde las pescas de camarones de aguas profundas, *Hymenopenaeus robustus*, indicaron una distribución irregular y la posibilidad de que ocurren en grandes concentraciones.

A Practical Method of Dispersing Aureomycin* Chlortetracycline In Ice

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The obvious commercial and economic advantages to be gained by the use of any agent which would extend the storage period of organic materials liable to spoilage, has directed the interest of many workers toward this field. After several years of extensive work Dr. H. L. A. Tarr[1] and colleagues have concluded "that chlortetracycline was more effective in preserving such foods (meats and fish) than any other of fourteen antibiotics studied". Others who have worked in this field are E. A. Fieger[2], C. P. Idyll[3], and F. E. Deatherage[4]. Early investigators demonstrated that when

* *The trade mark of the American Cyanamid Company for the Antibiotic Chlortetracycline is Aureomycin.*

solutions of antibiotics were frozen, severe migration towards the center of the ice cake occurred. This problem was overcome for experimental purposes by the use of flake ice[1] or by freezing thin layers of the solution in shallow trays and crushing with an "Ice Queen" crusher[2]. However, since block ice represents 95% of the commercial form it was of prime importance that a method be found which could be applied to the existing commercial ice manufacturing systems with a minimum of change. Consequently, investigations along this line were initiated in this laboratory which culminated in the development of a feasible commercial method.

The first approach was the use of various thickening agents to increase the viscosity of the solutions to be frozen, in the hope that this purely physical phenomenon would retard movement of the antibiotic towards the center of the ice cake. The importance of any retarding effect is shown when consideration is given to the extent of concentration of the antibiotic which develops when the antibiotic migrates two inches towards the center of a standard 300 lb. ice cake. In such an event, more than 50% of the ice will contain no antibiotic at all. If such a cake were crushed and used, erratic results could be expected. However, since in actual practice migration is almost 100% to the center, such ice would be completely worthless for the purpose intended.

A large number of thickening agents were systematically investigated. Since migration was prevented by some of these and not by others, it was readily apparent that a simple change in viscocity would not prevent this phenomenon of migration. For example, locust bean gum, polyvinyl pyrrolidone, acacia, agar agar and various types of starches were ineffective, while substances such as Irish moss (carrageen), carboxymethylcellulose, gelatine and algin controlled migration with varying degrees of efficiency. Closer examination of the different substances studied showed that those which were effective in controlling migration contained acidic groups which conferred on them salt forming properties with metals. When these successful systems were studied with distilled water instead of tap water, the migration was as severe as that experienced when antibiotic solutions were frozen without any added colloid. This led to the assumption that one or more metallic ions in the water were involved in the prevention of migration. This was proved to be true by employing systems using distilled water and adding various metal salts. It was then found that some of the metallic ions as shown in Table 1 were effective and that at least one or more of these ions were a necessary part of this system.

Previous work in this laboratory with polymeric materials, tetracyclines (particularly chlortetracycline) and metallic ions indicated that reactions involving complex formation, salt formation, or both, with the metal acting as a bridge between the polymeric substance and the tetracycline used, occurred quite readily under certain conditions. A similar type of reaction was assumed to occur here. This also led us to suspect that Aureomycin chlortetracycline would prove to be a most efficient antibiotic for the present purpose. Exhaustive experiments showed this to be the case.

The pH of the system plays an important role for it was demonstrated that below a pH of 7 efficiency decreased (Figure II). If the solution were too strongly alkaline, some potency losses might be expected.

The ice cake may then be pictured as having a gel structure of fairly

TABLE 1

Effect of Metallic Ions on the Migration of Aureomycin Chlortetracycline·HCl in Frozen Sols

Unit Charge:

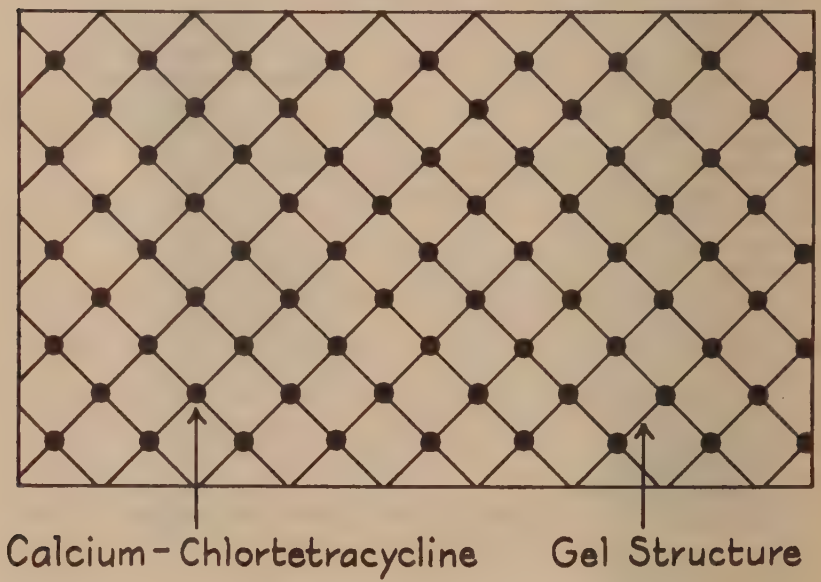
6 liters ..... Distilled Water
1 gm. ..... Carrageen (SeaKem No. 9)
180 mg. (30γ/ml.) ..... Chlortetracycline·HCl

Metal	Added - gms.		% Retention in Outer Periphery
Aluminum	1.0	$Al(OH)C_2H_3O_2 \cdot xH_2O$	16
Barium	2.0	$Ba(OH)_2 \cdot 8H_2O$	11
Bismuth	1.0	$BiCl_3$	very low
Cadmium	1.0	$CdCl_2$	72
Calcium	0.25	$Ca(OH)_2$	71
Cerium	1.0	$Ce(NO_3)_3 \cdot 6H_2O$	very low
Cerium	1.0	$Ce(SO_4)_2$	32
Chromium	1.0	$CrCl_3$	very low
Cobalt	1.0	$CoCl_2 \cdot 6H_2O$	71
Copper	1.0	CuCl	very low
Copper	1.0	$CuSO_4 \cdot 5H_2O$	very low
Iron (Ferric Glycerophosphate	1.0	$Fe_2[C_3H_5(OH)_2PO_4]_3$	very low
Iron (Ferrous Gluconate)	1.0	$Fe[CH_2OH(CHOH)_4CO_2]_2 \cdot 2H_2O$	very low
Iron	1.0	$Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$	complete
Iron	1.0	$Fe(NH_4)_2(SO_4)_2 \cdot 12H_2O$	98
Lithium (Lithium Citrate)	1.0	$C_6H_5Li_3O_7 \cdot 4H_2O$	very low
Magnesium	1.5	$MgCl_2 \cdot 6H_2O$	75
Manganese	1.0	$MnCl_2 \cdot 4H_2O$	complete
Mercury	1.0	$HgCl_2$	51
Molybdenum	1.0	$Na_2MoO_4 \cdot 2H_2O$	very low
Nickel	1.0	$NiSO_4 \cdot 6H_2O$	89
Potassium	1.0	KI	very low
Selenium	1.0	H_2SeO_3	very low
Silicon	1.0	$Na_2SiO_3 \cdot 5H_2O$	very low
Strontium	1.0	$SrCl_2 \cdot 6H_2O$	51
Tin	1.0	$SnCl_2 \cdot 2H_2O$	very low
Tin	1.0	$NaSnO_3 \cdot 3H_2O$	very low
Tungsten	1.0	$Na_2WO_4 \cdot 2H_2O$	very low
Vanadium	1.0	$NaVO_3 \cdot H_2O$	very low
Zinc	1.5	$ZnCl_2$	28
Zirconium	1.0	$ZrO_2 \cdot xH_2O$	very low
Zirconium	1.0	$ZrOCl_2 \cdot 8H_2O$	very low

The value of per cent retention in the outer periphery is the per cent of the theoretical value with complete inhibition of migration of the antibiotic towards the center. Where it was indicated to be very low, less than 10% of the original amount remained.

uniform consistency throughout with the antibiotic bound to this gel through the mediation of metal ion bridges as shown in the schematic drawing, Figure I.

Figure I



Experiment I

Chlortetracycline·HCl, Polyvinyl Alcohol and Calcium

The following materials were mutually dissolved in six liters of tap water containing about 0.25 gm. of calcium ion by analysis:

500 mg. .....Polyvinyl Alcohol (Elvanol 71-24)
180 mg. .....Chlortetracycline·HCl

The solution was placed in a freezing chamber and frozen at −10°C (14°F.) until completely solid. The frozen cake was removed and split in half from top to bottom along the diameter. An intense yellow core in the innermost section was disclosed, while the outer peripheries were devoid of all traces of chlortetracycline.

Chlortetracycline·HCl, CMC (Sodium Salt of Carboxymethylcellulose) in Tap Water

The following materials were dissolved in six liters of tap water by stirring with a mechanical stirrer until a homogeneous sol was obtained:

1.0 gm. .....Cellulose Gum (Hercules, Type 70-D, High)
180 mg. .....Chlortetracycline·HCl

The above sol was frozen at −10°C. until completely solid. On removal from the container wherein the sol was frozen, a cake of a uniform light

yellow color was revealed. By fracturing the material into two equal sections along a diameter, this light yellow color was found to be distributed evenly throughout the cake. Over 80% of the theoretical amount of active material was found in the outermost section by spectrophotometric analysis.

Experiment II

A Sol of Chlortetracycline·HCl and CMC in Distilled Water

Six liters of a homogenous sol consisting of 180 mg. (30 γ/ml.) of chlortetracycline·HCl and 400 mg. of CMC were prepared in a routine manner. The pH of the material was determined to be 6.2. After this material was completely frozen in a container, the contents of the container were removed and examined. It was discovered that migration of the antibiotic to the center of the cake was extremely severe. By analysis, it was found that eleven times more antibiotic was concentrated in the center than was found in the outside portions of the ice cake.

A Sol of Chlortetracycline·HCl, CMC and Calcium in Distilled Water

The above experiment was repeated using 100 mg. of $CaCl_2$ in addition to the above formula. The total formula—

6 liters	Distilled Water
180 mg.	Chlortetracycline·HCl
400 mg.	CMC (Carboxymethylcellulose)
100 mg.	$CaCl_2$ (anhydrous)

The pH was again found to be 6.2. The analysis of the frozen cake now showed that the ratio of antibiotic in the innermost portion to the outside periphery was 1.3 to 1.0.

Experiment III

Chlortetracycline·HCl and Carrageen

It was expedient that a polymeric material which could be dissolved in cold water be found. Carrageen proved most suitable. 180 mg. of Chlortetracycline·HCl and 1.0 gm. of carrageen (SeaKem No. 9) were dissolved in six liters of tap water by stirring at room temperature. The sol was then completely frozen at –10°C. After removal of the cake from its container, the cake was inspected visually and it became easily discernible that a homogeneous dispersion had been obtained. Analysis of the innermost and outermost sections proved that a ratio of 1.0:1.0 existed.

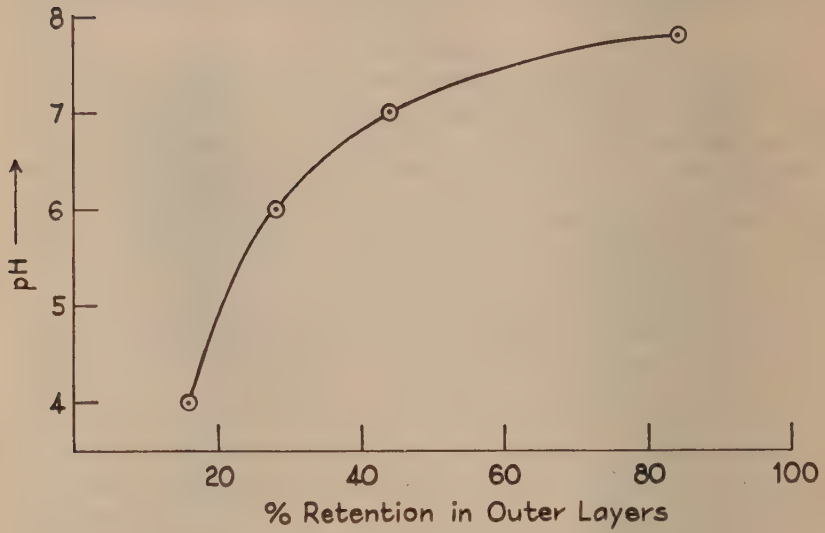
Experiment IV

pH Effect

A series of experiments was conducted to determine the effect of pH on migration of the chlortetracycline in a freezing sol. 500 mg. of carboxymethylcellulose (CMC) and 180 mg. of chlortetracycline·HCl were dissolved in six liters of tap water and the pH adjusted with hydrochloric acid. The use of organic acids instead of mineral acid did not alter the effect. The resultant sols were frozen and the outer layers analyzed. The results are given in Figure II.

Figure II

Effect of pH on Migration of CTC in Solutions



Commercial Preparations of Antibiotic Ice

I. The procedure used employing carrageen in solution was as follows:

A 0.5% aqueous solution of carrageen (SeaKem No. 9) was prepared by sifting the carrageen slowly into water using good agitation of the water. A 300 lb. container was filled to the desired level with tap water and the contents agitated using an air bubbler. To this 500 ml. of carrageen solution was added, followed by the chlortetracycline·HCl and calcium salt. Better results are obtained if no "anti-crack" compounds are used. Agitation was continued for about ten minutes after the last material was added. Then all agitation was of necessity discontinued during the freezing cycle. When the cake was completely frozen it was removed from its container in a routine manner. Six such cakes were frozen simultaneously in a typical run. After removal from its container, the long rectangular cake was split as shown in Figure III.

The cake was sampled and analyzed at the cut surfaces as shown in Figure IV.

On the top half of the cake in the metal container was a three inch layer which was usually more opaque. This was the solution which arose to the top as the volume increased due to expansion of the freezing material. This was sampled and identified as Section D. Sample A was the innermost core, B was the main bulk of the ice and C was the surface next to the container. The concentration in each sample was determined by chipping off approximately 300 gm. of ice from the desired portion, letting the bulk of the sample melt, and then withdrawing an aliquot of the sample. The

Figure III

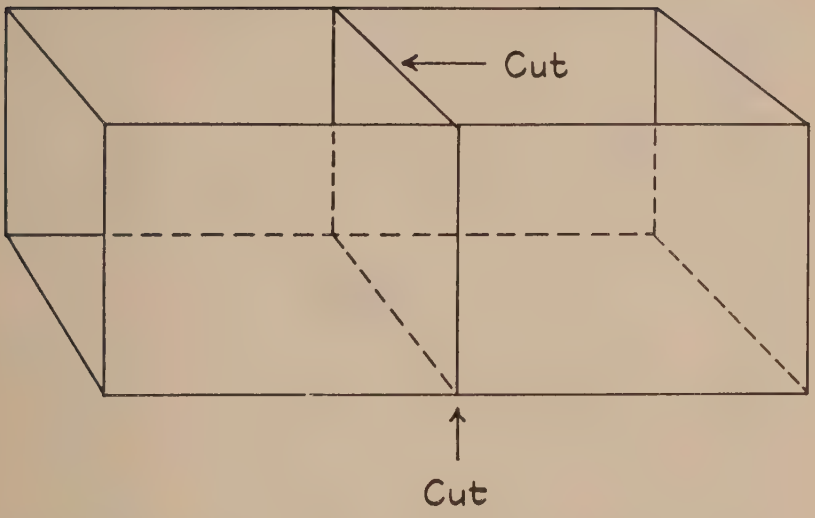
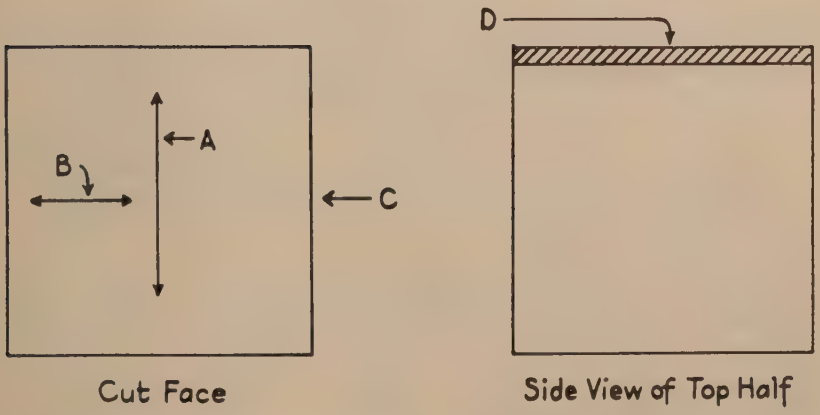


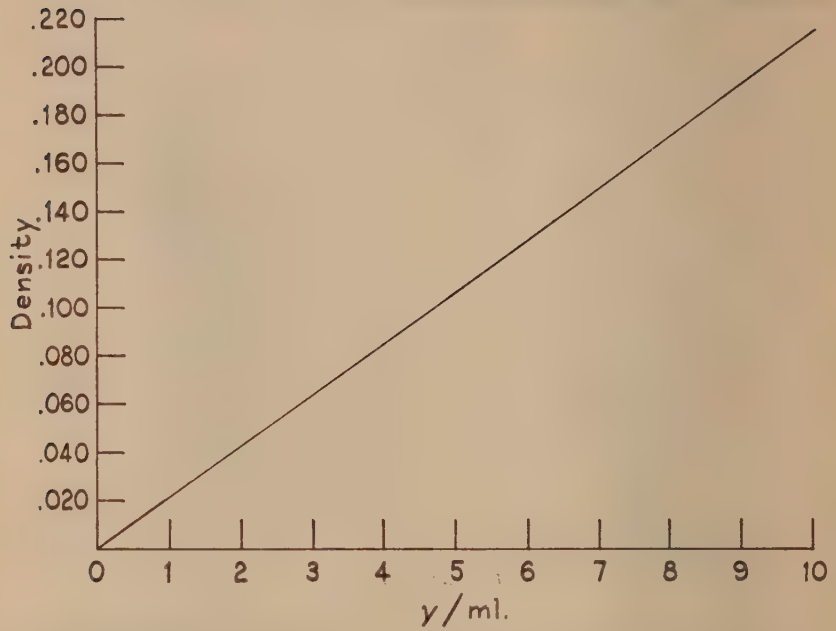
Figure IV



aliquot was diluted with an equal volume of 0.1 N HCl. The spectrophotometric analysis was determined on the diluted aliquot using a blank prepared of composition similar to the diluted aliquot, but containing no chlortetracycline·HCl. The concentration of the sample read was determined from the predetermined concentration cure at 3700Å using a Beckman, Model DU spectrophotometer. Figure V.

Figure V

Chlortetracycline Concentration Curve



The following materials were the unit charge per 300 lb. container:

685 mg.	Chlortetracycline HCl (5.0 γ/ml.; 1 γ = 1 part per million)
2.5 gm.	Carrageen
1.0 gm.	Calcium Acetate
300 lbs.	Water

The analyses are presented in Table II.

TABLE 2

SPECTROPHOTOMETRIC ANALYSES

Section	A	B	C	D
Cake No.	γ/ml.	γ/ml.	γ/ml.	γ/ml.
1	7.4	3.6	3.2	3.8
2	6.4	3.8	2.9	3.6
3	6.9	4.4	3.2	4.8
4	6.6	4.6	3.1	5.4
5	6.6	4.2	3.0	15.5 (?)
6	6.5	4.5	3.5	5.2

Average: 4.2 for Section B

II. The procedure using a homogeneous dry mixture of the ingredients was as follows: Three 300 lb. containers were filled from an overhead reservoir in a routine manner and placed in brine at –10°C. After air agitation had been started the following unit charge was added by slowly sifting into the water the blended powders from a standardized measure (ca. a tablespoonful):

685 mg. .....Chlortetracycline•HCl
2.5 gm. .....Carrageen
1.0 gm. .....Calcium Acetate

After the mixture had been initially agitated for fifteen minutes, this agitation was discontinued for the balance of the freezing cycle. The results and analyses of a set of cakes prepared from a dry mixture are given in Table III.

TABLE 3

SPECTROPHOTOMETRIC ANALYSES

Section Cake No.	A γ/ml.	B γ/ml.	C γ/ml.	D γ/ml.
1	6.9	2.7	3.7	6.5
2	6.4	2.7	3.5	4.8
3	6.8	3.2	3.7	4.6

Average: 2.9 for Section B

When such cakes were pulverized and the melting ice analyzed, close to theoretical values were obtained. Some slight variations occur, depending on the geographic location of the source of water.

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Un Método Prático para Dispersar Aureomycina, Chlortetracycline, en Hielo Comercial

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Abstracto

Se ha encontrado un método, que tiene posibilidades comerciales, para dispersar Aureomycina en bloques de hielo de 300 libras, hecho para prevenir

deterioración bacteriológica y para extender la duración de almacenaje de pescado y otros productos alimenticios. La tendencia de ciertas soluciones de antibióticos de migrar al centro durante el congelamiento, se ha vencido con el uso de muy pequeñas cantidades de ciertos coloides protectores en combinacion con iones metálicos.

El efecto del pH, tipo de coloides protectores, así como los tipos de iones metálicos son todos interdependientes y han sido estudiados concienzudamente tanto en el laboratorio como en plantas comerciales de hielo. El método se describe en detalle y también se explican métodos para análisis.

DISCUSSION

Technology and Exploratory Fishing Session

Discussion Leader: JOHN ROBAS

Discussion Panel: WILBUR H. MILLER, GEORGE STEELE, WAYNE M. WALLER

Further Experiments On the Control of Melanosis Or Black Spot On Shrimp

M. E. BAILEY AND E. A. FIEGER

Q. Robas: Have there been any taste panel tests made on sulphite treated shrimp?

A. Bailey: Yes. We found that in the shrimp treated with 100 parts per million sulphite there was no perceptible flavor that could be attributed to the sulphite. In slightly higher concentrated ices a few individuals acutely susceptible to the sulphite taste did actually pick it up, but there is, in my opinion, no appreciable change in flavor attributable to the sulphite.

Q. Miller: I am interested in the effect of the pH of your solution on the action of the sulphite and the ascorbic acid in controlling melanosis.

A. Bailey: The pH is very important in melanin formation. The farther the pH is from the optimal for activity of the enzyme the less is the melanosis development.

Q. Miller: The stability of ascorbic acid is somewhat dependent on the pH also, and I wonder if you used sodium ascorbate, would it be more effective than the sodium bisulphite? I notice that you used 8% ascorbic acid and 92% citric acid.

A. Bailey: The primary reason that we used the 8-92 mixture was to cut down the expense. Actually, the ascorbic acid, full strength, does a wonderful job in preventing melanosis, but at the present time it is much too expensive to be

considered for commercial use. True, the citric acid also acts to decrease the pH, and this in itself decreases melanosis somewhat.

Q. Butler: In connection with the organoleptic tests did you at the same time run any storage tests? I am interested in the effect of sulphite concentrations after a six months storage.

A. Bailey: No. They were checked only over a period of 16 days.

Butler (Comment): We have found in our work with fish that samples sometimes do not at first show flavor changes, but on storage do develop undesirable flavors.

Q. Strasburger: Did you make any bacteriological examinations?

A. Bailey: Yes, we made bacteriological examinations along with a series of eight chemical tests for quality. We found that the sulphite ice-stored shrimp were a better product than those in the commercial ice.

Q. Strasburger: What was the change in the bacterial flora on the sulphite shrimp as against those stored in regular ice?

A. Bailey: All tests mentioned were total plate counts. There was no appreciable difference in the bacteriological counts until about the 14th day, but after this storage period there was an appreciable difference in the number of bacteria in the two samples. Concerning the shrimp in ordinary ice, there was a tremendous increase in the number of bacteria after about 14 days, and although the sulphite treated shrimp wasn't completely devoid of bacteria, there were considerably fewer bacteria in the samples that had been treated with the bisulphite.

Q. Strasburger: Would you attribute that to the differential in pH?

A. Bailey: That is a possibility, of course, but we haven't made a thorough study as to the actual mechanisms.

Q. Anderson: Have you discussed the results of your experiments with the Food and Drug Administration? If so, what are their views as to the level of the sulphite solutions which might be used?

A. Fieger: The New Orleans Laboratory of Food and Drug said that it would have to be shown that there was no bisulphite in the cooked product. This is unofficial and the ruling would have to come from Washington.

Q. Szabo: How much would this sulphite treatment cost per pound of shrimp?

A. Bailey: A 1000 ppm. sulphite ice would increase the cost of a ton of ice by about 50 cents. With a cruder sulphite we would have to increase the concentration but this would also decrease the cost considerably, so I wouldn't doubt that you get the cost to about 30 cents extra per ton of ice.

CHARLES B. BOWLING

Q. Robas: Is there any work being carried on now by American railroads which compares with the refrigerated freezer cars which the Canadian National Railway is experimenting with?

A. Bowling: Yes, there are. General Motors has an experimental railway car in Florida. It cost them approximately $30,000 to equip, and, of course, that is too expensive to operate commercially at a profit. We may see some such car in service on perishable freight in the near future.

Q. Steele: Did I understand you right this morning when you said that you had been able to carry out tests on refrigerated transport of various farm crops, but you had been unable to get those same tests run on fishery products?

A. Bowling: The Bureau of Plant Industry of the Department of Agriculture has for years undertaken an extensive amount of experimental work with agricultural products, but, of course, they have not entered the field of fishery products. I have recommended that similar tests could be run on fishery products by some other government agency, preferably the Department of Interior. I am certain that the Department of Agriculture would be glad to cooperate with them.

Q. Steele: Hasn't it been ruled that fish and shell fish are under the jurisdiction of the Department of Agriculture in this particular field of endeavor?

A. Bowling: Only insofar as transportation rates and service are concerned, but not concerning experimental work.

Q. Xavier: We have a number of officials here from the Fish and Wildlife Service and I think they could tell us if cooperative research would be possible.

A. Anderson: The last time we discussed the possibility of joint work with the Department of Agriculture was several years ago. We have never been able to make the proper arrangements, largely because fish, fruits and vegetables aren't produced in the same areas. We have run into technical difficulties in arranging cooperative tests. However, Agriculture has been perfectly willing to work with us and we're still willing to work with them if we can solve these problems.

Q. Waller: Am I correct that the majority of shipments of seafood to the interior are less-than-car-loads?

A. Bowling: Yes.

Q. Waller: I understand the thing that really put Chicago, Omaha and Kansas City in the meat packing business was carload movements of meat to consuming areas. It is not practical to accomplish car load movement of frozen seafood products to the interior for distribution?

A. Bowling: Undoubtedly the railroads would afford much lower rates for a heavy volume. If, instead of 3, 4, or 5,000 pounds, we could ship 30,000 pounds in a refrigerated car we would then get a much lower rate.

Q. Waller: I don't understand why it wouldn't be practical for the sea food industry to move that much volume.

A. Bowling: I assume because the distribution of seafood in such large quantities can only take place to the main cities. A good deal of the seafood of the country is now being moved by motor truck and the trend seems to be increasingly in that direction, which will account for the loss of carload shipping which was formerly a paramount part of the railway distribution of seafood.

Q. Kahn: The last part of Mr. Bowling's paper refers to the sharing of risk. We have had cases in which the question of risk became an important one to the fish distribution. In one case a truck load of shrimp on their way from Port Isabel to New Orleans was stolen. Since it was not recovered until two days had passed, the shrimp were not in good shape. Who is responsible for the deterioration in quality of the seafood in this case? The shipper had double insurance: from his own insurance company and from the company of the common carrier. When it came to collecting the money, both insurance companies refused payment, because they said delivery was interrupted by causes for which they were not responsible. He also failed when he tried to collect from the common carrier since the carrier was unable to pay. The question is first, is there a legal basis that would require common carriers to carry insurance for such cases? Secondly, is there a list of common carriers who are responsible and who are able to pay for losses and will not try to escape legal obligations?

A. Bowling: The Interstate Commerce Commission has a list or record of all certificated carriers. The assumption is that the shipper will on his own account investigate whether the carrier is responsible and if the carrier is covered by liability insurance. The Interstate Commerce Commission may require any such common carrier to file a surety bond for the purpose of compensating shippers or consignees for losses. This is contained in Section 215 of the ICC Act. The situation in question would seem to be one for the courts to adjudicate.

The Practical Application of Immersion Freezing of Shrimp On A Conventional Trawler

W. L. Mingledorff, Jr.

Q. Robas: What is the pressure at which your hydraulic agitator operates; is it a high pressure or a low pressure hydraulic system?

A. Mingledorff: With the light load encountered in the agitator it operates around 600 pounds. It is a high pressure pump. It's the same pump used on hydraulicly operated bulldozers to lift the blade, and will go up to 2000 pounds.

Q. Robas: In your slide this morning, you showed the three baskets of shrimp being placed on top of the freezer cabinet to drain, prior to being placed in boxes and stored in the hold. What prevents those baskets from sliding around and falling back in the freezer when the vessel rolls?

A. Mingledorff: The basket is fairly wide on the bottom and when you set it at an angle it does not tend to move.

Q. Robas: The question that most concerns me about the operation of equipment aboard a vessel is the ability of the men to operate it. We find frequently that it is difficult to get the crew to keep a gasoline light plant operating. If vibrations cause leaks in the refrigeration systems, what can the crew do?

A. Mingledorff: The refrigeration circuit is completely sealed and we don't want the crew to do anything. It would take a major leak to stop the system. The two systems are inter-connected so that the crew can switch from the refrigeration of the freezing tank and put that refrigeration unit on the holding room. The holding room is divided in sections so that if a leak develops even an unskilled crew can close the valve and isolate that section. As far as maintenance is concerned, if the crew has the intelligence to operate the main engine we feel they can operate the refrigeration. It is operated simply by cranking up the diesel and putting in the clutch. Once a week you check the oil in the diesel, and you still should not touch the refrigeration circuit.

Q. Steele: I would like to ask Mr. Mingledorff a question that pertains not so much to his particular process of freezing shrimp as it does to the effect of freezing shrimp on subsequent quality, if they are to be thawed, for breading purposes. We have had this problem presented by the Florida State Board of Health. Mr. Mingledorff, you said this morning that using your process of immersion freezing that you had thawed out the shrimp as many as five times with no noticeable difference in the quality of the shrimp. Is that right?

A. Mingledorff: At the end of five thawings and freezings, there were no visual signs of deterioration. This is due to the extreme rapidity of the freezing.

Q. Steele: One of the largest breaders that we have in Florida is of the opinion that it is impossible to thaw out any frozen product, including shrimp, without a resulting deterioration in that product.

A. Mingledorff: I think that you'll find that the bulk of the breading industry is using frozen products.

Q. Steele: I believe you did some work on the brine system of holding shrimp. There was a time when that development was said to be one of the answers to holding shrimp aboard a trawler.

A. Mingledorff: At the time we started developing the refrigerated sea water we had no idea that the boat would ever want to hold fresh shrimp over 14 days. It became very obvious as soon as we started trying to sell it that the larger boat operating from Campeche, Mexico, was now going to stay out 30 days, and that the system was not applicable. It doesn't mean that it failed, because I still think that basically we had a good answer for the problem as it was presented to us at the time.

Q. Steele: What is the cost of this system?

A. Mingledorff: Approximately $12,000. The skipper of the *Prince Charming* estimates that just taking the saving of 5½ cents a pound that he would pay for freezing charges. This is plus the fact that all of the shrimp he sells are given the quality of "pearls".

Q. Miller: I am interested in the skill of Mr. Mingledorff's crew and in the point made that the quality of shrimp the consumer got would be not better than the quality when landed. I am particularly interested in how thoroughly the shrimp were washed on board the boat. I wonder, in the industry as a whole, how you are going to get crews that will head and wash shrimp thoroughly?

A. Mingledorff: I don't think there is any question as to the willingness of the crew to wash thoroughly. Most of them operate on shares and if their shrimp are graded as "pearls" they get more money; they'll wash shrimp thoroughly to get this.

Q. Waller: Would you tell me the concentration of sugar in the solution and its function?

A. Mingledorff: I've been trying to keep the solution secret. That's about the only thing that I have to sell. It is approximately 50-50 sugar and salt. The sugar is very important from the standpoint of the glaze. The salt functions only to lower the freezing point. In order to freeze at 0° F., we have to have a high concentration of salt and sugar. I might say that the basic information came from the Fish and Wildlife Service reports on glucose and salt. This is not new, it's been in the industry for quite a while and was used on fish fillets for some time.

Q. Anderson: Are shrimp prepared by your system available in consumer packages in Washington?

A. Mingledorff: No, most have gone to Food Fair stores in Miami, and have appeared on the counters in bulk.

Q. Robas: Mr. Charles Ludwig is using a more conventional freezing method shelf freezer. I wonder if he would tell us something about his experience with this type of equipment and

indicate his opinion of how it would compare with the immersion freezer.

A. Ludwig: My plate freezer is not too satisfactory. When the lines are frozen there is a lot of aggravation with it.

Q. Robas: Do you consider that you have a good crew on the vessel?

A. Ludwig: I have one of the best. They work hard and it still doesn't pay.

Q. Ferguson: According to the Food and Drug regulations when you sell a product you have to list what it contains. Do you have to advertise that the shrimp have had salt and sugar added?

A. Mingledorff: Apparently not in this case. Salt and sugar make up the freezing medium and are not necessarily added to the product.

Q. Ferguson: Do you think that plate coils could be used in freezers in place of the customary copper tubing which is used in shelf freezers such as Mr. Ludwig has. Do you think that the use of those prefabricated coils would cut down the leakage?

A. Mingledorff: We have had systems operating three years without a leak. We have had minor leaks on the *Prince Charming* but our system is so concentrated compared to a conventional installation that I anticipate that we will have fewer leaks.

Q. McKee: I sold the first shrimp produced using this equipment. The first load went to Food Fair stores in Miami. They were thawed out and sold as fresh shrimp with very good success, and Food Fair wanted the next load from the *Prince Charming*. However, it was sent to a processor. At the plant they had most of them graded before the temperature had risen appreciably. The remainder of the large shrimp (16-20 count) were packed and refrozen headless. Now this company wants the next load coming in. These shrimp are the finest I've ever seen. I believe that if a boat owner figured only the savings on the ice, fuel and unloading charges, he could pay for the equpiment, disregarding the premium he would get for the shrimp.

Q. Strasburger: It has been our experience that in order to peel shrimp they must be held under ice for from 4 to 8 hours. I'm wondering what the experience of the processor was in regard to these shrimp?

A. McKee: They did tell me it was a little more difficult to peel the shrimp because they were so fresh.

Fish Oils and Proteins: Their Contribution To the World's Feed Supply

Howard O. Sturgis

Q. Waller: I've been one of the severest critics of the menhaden industry over its apparent lack of interest in quality control.

Last week I heard a very encouraging report at the Virginia Fishermen's Association meeting of some work being done with aureomycin on the Gulf coast. Would you give this audience a quick run down on that project and its results?

A. Sturgis: We have been particularly interested in this work. We have been following very closely the work which the Fisheries Research Board of Canada and the Marine Laboratory of the University of Miami have been doing with aureomycin on edible fish and shrimp, because we felt that there might be some connection between that and the work that has been undertaken on menhaden. There has been developed a method of spraying the aureomycin in a fine vapor on the fish as they were dumped from the baskets, or as they were pumped on the menhaden vessels. It has been reported there was substantial improvement in the appearance of the fish and also a distinct improvement in the yield. Normally there is a loss of from 10 to as much as 25 or 30 per cent of yield. This can be an extremely important factor.

Q. Miller: I was certainly impressed this morning when I heard you tell about the nutritional advantages of fish meal for animal feed. Has there been work done to indicate any relationship between the nutritional value of fish meal or fish solubles with the quality of fish originally processed?

A. Sturgis: There has been a good deal of work done, more or less on a confidential basis. We know that the amino acid lysine, which is one of the most important amino acids and one in which the value is most easily destroyed, is lost as the fish decomposes. We know also that there are likely to be other losses, and we feel very strongly that anything that we can do to improve the raw materials will be of value to the feed industry.

Q. Fieger: What effort is being made to utilize trash fish caught in shrimping, and also the heads of shrimp?

A. Sturgis: There has been considerable effort to use that type of material. Many fish—not from shrimp boats, but other sources—that might have gone into reduction have been taken by the people who supply fish to the mink farmers. They are desperately short of proteins because the horse population of this country has virtually disappeared. The reduction plants can't pay as much as the mink farm suppliers. On top of that there are cat and dog food manufacturers, who can pay still more, so they are apparently getting the greatest amount of miscellaneous fish. Now, the question of shrimp trash and shrimp heads is somewhat different. The big shrimp boats head their shrimp at sea, and the shrimp heads don't come ashore at all. In other cases, where the smaller boats bring their catches ashore, they are apt to land very small quantities at any one particular spot. It

is a question of collecting those and sending them to a reduction plant, and frequently it isn't practical for them to make collections, although they do in some areas.

Q. Fieger: Is there a problem of rancidity when fish meal is added to feed?

A. Sturgis: Yes, especially with animal fats. There are enough natural anti-oxidants in most feeds when normal ingredients are used, but there are specific instances, especially in the north east area, where the fats and oils in the feed have such a high percentage of unsaturated fatty acids that they cause a problem. We do know today, however, that that can be completely overcome, as far as danger to chickens is concerned, by the addition of the proper anti-oxidant.

Q. Menzel: Back in the early 1940's the DuPont Company used the ribbed mussel to extract vitamin for poultry food. I've heard also of the use of star fish for fertilizer and for food. I'm wondering if there are any non-edible invertebrates used now?

A. Sturgis: I don't know of any.

Q. Osorio: I wonder if you are familiar with the tests that FAO is performing in a number of Latin American countries using fish meal for human consumption. The FAO Nutrition Division, supported by the Fisheries Division, drew attention to the little-explored possibilities of edible fish flours, containing up to 70 and 80 per cent of high quality protein as well as calcium and vitamin B_{12}. UNICEF showed great interest in this possibility and it was decided to choose Chile as a suitable place for large scale tests of fish flour in order to gain experience with its acceptability in local dishes and other food preparations. With the cooperation of the Chilean Nutrition Department, several fish flours have now been tested, including samples from South Africa, United States and Germany. Bread made out of nine parts of white wheat flour and one part of fish flour has been used for the tests with very good results for some of the samples. Each three-ounce bread roll contains about 6.3 gms. fish flour. This flour represents 4.8 gms. protein or the amount in four and a half ounces of milk and 446 milligrams of calcium, which is the content of about two glasses of milk.

Further tests of fish flours are now being carried out in Ecuador, Mexico and Peru. In Mexico, for instance, fish flour is being tried with tortillas made out of maize. We expect that edible fish flour will mean more fish for human nutrition.

A. Sturgis: There has been a great deal of interest in the USA in this experiment and that's one more reason why the National Fisheries Institute has decided that it was time we got away from the name of "by-products".

Q. Waller: It was certainly demonstrated to my satisfaction this morning that there probably is a tuna fishery in the Gulf. It also seems to me that with considerable ease you could take a substantial tonnage of sharks. Do you know of any interest at the present time in the utilization of sharks so that we have any promise of bringing to life another shark fishery?

A. Bullis: There is one outlet for shark livers that is just starting in Pascagoula. I believe that it is the first shark liver processing company that has been in operation for the last five or six years. The operators seem to think that they can pay a good price for shark liver. This would be a valuable by-product to long-line fishing in the Gulf. However, the most common off-shore shark is this white fin shark, which seems to have liver oil of close to the lowest potency of all species. There is also a possibility of a market for shark fins, and for shark skins there is a very good market available. As far as the meat is concerned, special tests by fish producers along the Gulf coast have not been too favorable to date.

Q. Robas: I wonder, Mr. Mowbray, if you would tell us whether or not there is the possibility of a tuna fishery along the island of Bermuda.

A. Mowbray: I definitely think so. We've been working on it for quite a while, and next year, if all goes well, I hope to present a paper describing a long line tuna industry off Bermuda. I would like to ask Mr. Bullis how the selection of the locality of the sets was made.

A. Bullis: We have been primarily trying to see in how wide an area we could catch yellow fin tuna. There was concentrated fishing in only one locality. Our emphasis next year will be more on trying to pinpoint localities. The last trip, which took place in the latter part of September and early October, was designed to give some picture of differential catch rates throughout the Gulf from east to west. We made eleven sets at one degree intervals, starting right off the continental shelf of Florida and heading over to Brownsville, Texas. Our catch rates show an increase as we approach the center of the Gulf and a very rapid falling off as we approach the Texas coast. The only oceanographic connection we can make with that observation is the fact that in the central Gulf there is one branch of the Gulf Stream that heads north.

Q. Robas: Mr. Wiles, I'm curious about the possibility of long lining tuna around Barbados.

A. Wiles: Nothing has been done to try long lining for big tuna in the Caribbean as far south as Barbados. It is on my program

for next year, but it will take three to four months more to get the gear prepared. Our bait will be flying fish. We can see the tuna and know they are there. A problem is that they are much bigger than those in the Gulf, ranging from 180 to 250 pounds.

Q. Mather: The opinion often expressed by taxonomists and sport fishermen is that there are two species of yellowfin tuna, an Allison and a common yellowfin, the Allison being long finned and the common one being short finned. All of this has been based on rather flimsy evidence. Could you make a comment on this subject?

A. Bullis: My personal opinion on the subject is that it is a single species.

Q. Mather: The age of yellowfins in the Pacific has been estimated by length frequencies. Rivas and I found that length frequencies can be used to calculate age of bluefins in the Atlantic, and it would be interesting to check the age of the yellowfins you're taking with the age of the Pacific yellowfins, and also of the bluefins. The indication from the Pacific is that the yellowfin there grows much faster than the Atlantic bluefin although it reaches a smaller final size.

A. Bullis: We've plotted the length frequencies for the Gulf yellowfin, but only over a period of May to mid-October. From the curves it appears that there is a colossal growth rate. It seems comparable to that of the Pacific yellowfin. The size classes range from 10 pound average to 50 or 60 pounds, which would indicate a growth of perhaps 40 to 60 pounds in one year.

Q. Mather: This long line fishing not only indicates a great future in the Gulf but I think we can at least hope for good results in other tropical areas such as the Caribbean and the open Atlantic. We have found indications that there are yellowfins and other tuna-like fish in the Guiana current area, especially around the bulge of Brazil and even out into the Equatorial current system of the Atlantic. A tuna fishery should have several strings to its bow for it to be a success, with the fluctuations which occur in the abundance of fish in any particular area. What is the possibility of expanding your research in these areas, and do you think that possibly a West Indian tuna fishery could operate in the Gulf, the Caribbean, the Atlantic and possibly the nearby Pacific areas?

A. Bullis: We've achieved these results with very few surface indications of the presence of yellowfins. We had no previous records to go on, and if we can make catches like these where they have never been seen previously, certainly we ought to be able to duplicate them in areas where yellowfin are repeatedly reported. Our cruise schedule for next year includes two cruises that will make transect from the

central Gulf down into the western Caribbean. Yellowfin tuna extend in a band completely around the world from the Gulf of Mexico to the Pacific coast of Central America, and commercial fishing linking up the areas you mention is actually opening now on a small scale.

Exploitation of Deep Water Shrimp In the Gulf of Mexico

STEWART SPRINGER

Q. Robas: How does the shrimp captain locate these deep beds? Working in 180 to 250 fathoms of water, it seems that it would be impractical to use a try net; he would be spending all of his time pulling the try net.

A. Springer: He would merely trawl in the area. Apparently in the areas where these shrimp occur they are reasonably widespread, and time drags are probably in order. Of course, it would be necessary to have more elaborate equipment than usual, including a deep depth sounder, and perhaps loran would help him locate the spot. Actually the depth range is very precise, so it would be easy to get into a shrimp producing area if the area were known and if the boat had satisfactory equipment.

Q. Higman: As a student I was in 1951 a Fishery Aide on the *Oregon*. You were catching some of the red shrimp off the Mississippi Delta. My job was recording bottom temperatures and other hydrographic data. Have you found any temperature correlation with the occurrence of these shrimp?

A. Springer: I don't know whether there is any correlation. Our records on bottom temperatures at 200 to 300 fathoms are scarce.

Q. Miller: I am interested in the fact that you indicated that the carbohydrate concentration might be different in 50 to 270 fathoms compared with shallower water, because of the obvious implications for differential bacteria life. Do these shrimp have different keeping qualities compared with ordinary shrimp?

A. Springer: That is a problem that the industry would have. These shrimp are softer and I imagine they would be difficult to handle. They must be headed promptly or the juices from the head discolors them. Of course, they don't taste like the other shrimp and don't look like them so they are not necessarily competitive. We have frozen all our shrimp aboard the *Oregon* and we get a beautiful product. People who have seen them have indicated that there should be no problem in selling them. We don't know how they would keep under icing conditions.

Q. Steele: Nothing excites a shrimper more than the possibility of finding new shrimp grounds. Mr. Springer, do you regard the red shrimp as a marine oddity or is there a good possibility of another fishery in the Gulf?

A. Springer: I can't answer that very well, but I do think that there are in the Gulf very large untapped shrimp resources. These may be as large as the shallow water shrimp resources. For immediate interest, there were large boats idle last year which could have entered into some commercial exploitation of these deep water shrimp. Had they been equipped to fish these deep areas, I think they could have made successful trips. Of course, so far we don't know of more than two or three places where the shrimping would be good for this one shrimp, *Hymenopenaeus*. I think that there are more, but that is just a guess.

Q. Steele: What is required in the way of equipment to adapt a vessel for this shrimping?

A. Springer: A depth sounder that is capable of operating down to 300 fathoms. In addition, the winch should be capable of handling a minimum of 700 fathoms of wire. If half inch wire is used, I suspect that a bridle system would be desirable. This is not possible with most winches that have been used on shrimp boats because the drums aren't large enough to accommodate 700 fathoms of half inch wire.

Q. Steele: Am I right that these red shrimp have been marketed commercially?

A. Springer: No. We have turned some of them over to a shrimp company for examination. They report that the shrimp probably would not be suitable for canning. They would find a premium market solely as a frozen product, in all probability.

A Practical Method of Dispersing Aureomycin in Commercial Ice

S. D. Upham and F. E. Stirn, J. F. Weidenheimer, F. M. Callahan and L. Ritter

Q. Miller: Dr. Upham, you have indicated that the antibiotic was available after it had acidified. What is of particular concern is the availability of the antibiotic as the ice melts. Could you tell us about any experimental work you may have done on this?

A. Upham: We have checked our spectrophotometer analysis against bacteriological assays. As far as we can see, we have the whole assay value from this ice. In fact, if you make the insoluble compound from calcium, aureomycin, and one of these gels in a very concentrated solution, you can even isolate and dry it, and it retains full activity.

Q. Steele: I'm interested in the relationship of Dr. Fieger's sulphite and aureomycin. Do we need both of these or will one do the job? If we need two can use both of them at the same time?

A. Upham: I'm not sure whether you can use aureomycin with sulphite or not. I don't know how you can keep the bisulphite from migrating in an ice block.

A. Fieger: We haven't done any work in trying to prevent the migration of the sulphite during the freezing of ice, but we plan to start work on that immediately.

Q. Robas: I would like to ask Frank Welles if he would tell us briefly of the experiments with the use of aureomycin on red snapper.

A. Welles: We have run one test of the aureomycin ice on one of our vessels. We iced 75 pounds of fish in each of two boxes, one with regular ice and one with aureomycin ice. Each box was handled identically all the way through the trip. At the end of a five day period we took a fish from each box and froze them; at the end of 10 days we froze another fish and after 15 days we froze a third fish from each box. Unfortunately we weren't able to complete the test our our satisfaction because bad weather developed in the Gulf and our boat had to go into Galveston. In trucking the fish back to Pensacola, it wasn't handled as well as we wished, but the results that we had on the bacterial counts indicated clearly to me that aureomycin has definite possibilities, in fact fantastic possibilities in the preservation of fish. One of the things that I rely on, of course, is the opinion of the men of the vessel itself. The captain of this vessel, who is one of the best in the Gulf, told me that after four days in the ice he could see a definite difference in the appearance in the fish. We plan to run another test the first part of December, when we will ice down considerably more fish, and I think that at that time we will get some conclusive results.

Q. Fieger: Dr. Upham, you reported that Tarr had obtained remarkable results with the aureomycin on fish. Did he use the aureomycin with the colloid and the calcium to freeze it into ice blocks?

A. Upham: Yes.

Q. Fieger: Do you have any explanation why the aureomycin is effective on fish and is not so effective on shrimp?

A. Upham: I really don't know, unless it concerns differences in penetration.

WEDNESDAY—NOVEMBER 17

Chairman—RICHARD A. KAHN, *Chief, Economic and Cooperative Marketing Section, U. S. Fish and Wildlife Service, Washington, D. C.*

Introduction To the Problems of Marine Insurance In the Fishing Industry In the United States

RICHARD A. KAHN

Chief, Economics and Cooperative Marketing Section, U. S. Fish and Wildlife Service, Washington, D. C.

The problems of marine insurance, whether in the Caribbean area or in the United States, are everywhere of the same kind and of the same urgency. The complaints in the fishing industries, as far as the United States is concerned, refer to insufficient insurance protection, and are especially noticeable in the Boston, Mass., area, in the New Bedford, Mass., area, and the Tampa, Florida area. In other coastal areas of the United States there prevails comparatively greater satisfaction with the present status of marine insurance in the fishing industries.

Before discussing in detail the problems involved, it would be profitable to make clear what we mean by marine insurance in the fishery industries. Marine insurance in the fishing industries includes two fields of insurance which are completely different and therefore deserve separate attention. These are "hull insurance" and "protection and indemnity insurance".

In hull insurance, the most important phase involves the vessel itself, and the vessel forms the basis of the insurance. Therefore, in each type of marine insurance in which private companies are the entrepreneurs the vessel is the first object of consideration. The insurer will investigate, for instance, how well the vessel is built, whether it can safely carry fish, ice and men, the type of marine engine used, and whether it is a steel ship, a wooden ship, or a composite ship. With hull insurance most insurance policies specify in the policy a certain value of the vessel which represents the limit of the payment obligation of the insurer.

Hull insurance may be subdivided into four general divisions—sailing vessels, auxiliary sailing vessels, steamers and motor vessels. This last category is the most important as far as the fisheries are concerned. Hull insurance may be placed on trip risks or it may be placed on an annual or time basis. A trip insurance policy is one whose terms are mainly geographical; that is, a risk insured from one port to a fishing area and return. An insurance on time is limited entirely by the date of attachment and the date of termination. In the United States, there is, by law, no limit to the time for which a policy may be written. However, it is customary to write hull insurance on fishing vessels for one year.

The hull insurance policy usually includes a collision clause under which the hull insurance underwriter assumes responsibility for damage to other

vessels by collision. This clause excepts, however, any liability for removal of obstruction under government direction for injury to harbors, wharves, piers, stages, or other similar structures subsequent to collision, or for loss of life or personal injury. These excepted risks can be covered by "protection and indemnity insurance", commonly called "P & I Insurance." However, P & I is a very broad insurance against nearly all liabilities of the vessel owner or his employees.

Marine "protection and indemnity insurance," means insurance against legal liability of the insured for loss, damage or expense arising out of, or incident to, the ownership, operation, chartering, maintenance, use, repair or construction of any vessel, craft or instrumentality in use in ocean or inland waterways, including liability of the insured for personal injury, illness or death or for loss of or damage to the property of another person. Whereas the hull policy protects the owner or charterer of a vessel against loss to his vessel, the P & I policy covers his legal liability risks in the operation of his vessel.

The protection afforded under a P & I policy may be grouped into three broad classes:

1. Liabilities with respect to persons
2. Liabilities with respect to other property
3. Unusual expenses to comply with government regulations and fines and penalties incurred by violation of law

A brief description of each class may be helpful in understanding the variety of liabilities with which a ship operator may be faced.

It is the responsibility of the operator to see that persons who have a right to be on board a vessel, *do not come to harm through his negligence.* This group includes the crew, ship visitors, passengers and stevedores working on or about the ship. The operator is also liable for unusual expenses incurred in getting sick or injured seamen to shore, and for the maintenance and medical care plus wages to the end of a voyage of seamen disabled by sickness or injury. He is also responsible for the care of such seamen left at foreign ports and the cost of getting them home when they have recovered.

The hull-insurance policy, in most cases, *includes a collision clause* under which the hull underwriter assumes responsibility for damage to other vessels by collision. This clause excepts, however, as printed out above, any liability for removal of obstructions under governmental direction, for injury to harbors, wharves, piers, stages or other similar structures consequent on collision, or for loss of life or personal injury. The P & I policy, subject to its terms and conditions, covers these excepted risks, except the "engagements of the insured vessel." There are other causes of damage to property, for which the P & I underwriter assumes responsibility, such as, a vessel that creates a wash that may cause other vessels to break their moorings or to be forced against dockers or driven ashore; similarly, a vessel that may be so negligently navigated as to crowd other vessels, causing collisions or stranding, a ship's tackle that may fail, causing cargo to be dropped on barges or lighters lying alongside.

A ship operator may be put to unusual expense by the enforcement of quarantine regulations. He may also have to pay fines or penalties for violation of federal, state, local, or foreign laws or ordinances by the owner, the

master, or his agents. The P & I policy, subject to its terms and conditions, assumes liability for these unusual expenses.

In short, just as the hull underwriter endeavors to cover losses resulting from the hazards to which hull is exposed, so insofar as practicable, the P & I underwriter covers the liabilities imposed by law or regulations upon the ship operator. Should the ship operator by special agreement or consent assume liabilities for which he is not legally responsible, such liabilities are not covered by the P & I policy.

As far as hull insurance is concerned, the difficulties arise from the fact that the premium, which is the amount that has to be paid by the insured to the underwriter, is mainly determined according to the value of the vessel which in case of loss must be replaced. A difficulty arises with the question whether the insured should receive the full replacement value and, if so, what is considered the replacement value. If a vessel was bought in 1934, it has certainly depreciated considerably; the insurer has to pay much less when he must present to the insured a 20 year old vessel or the monetary equivalent or when he must pay for a completely new vessel of the same size and the same type. That there are great differences in these two values may be seen from the fact that according to a Fish and Wildlife Service estimate, the accrued book value of the United States fishing fleet in 1953 was $326,565,-000, and the replacement value (i.e., if replaced by new vessels) was $568,-400,000.

Many difficulties arise from the fact that the insured wants to keep the insurance premiums low in order to keep the general business expenses low. However, in case of damages, the insured often is disappointed when he receives only payments commensurable with the low premium which are either insufficient to cover the repair cost of the vessel or insufficient to purchase a new replacement vessel. Even if both the insurer and the insured agreed to a more realistic insurance premium and to a more realistic damage payment, difficulties arise due to the fact that the underwriter is faced today, in the case of hull insurance, with a great increase in the rate of repair costs. Although the index of machinery costs from 1934 to 1954 increased only about 90 per cent, the cost of repairs increased about 200 per cent. This increase in costs may be due only primarily to the good business of ship repair yards and marine railways which started with the Korean War. It may be due also to high wages for craftsmen employed in such things as marine railways, based on the high living standards in this country.

The difficulties just mentioned are not lessened by the fact that repair costs or wages are temporarily declining. During the past ten years, despite temporary recessions, there has been, generally, an increase of costs and wages. The insecurity laid upon the shoulders of the underwriter regarding costs and wages is a deterrent to stable business.

As far as protection and indemnity insurance is concerned, the difficulties lie in the lack of proper legislation, limiting the liabilites of the vessel owner. It should not be too difficult to determine the proper cost of damages to a person who suffered these damages on board a fishing vessel due to the negligence of the owner. If fishermen would come under workmen's compensation as they do in Cuba, the law would provide for the limits of payment to the person who was damaged. Newfoundland also has such restrictive legislation. However, in the United States, under the common law and under the Jones

Act of 1920, the final decision as to compensation is given to the courts. Widows and children, parents, and other nearest dependent kin may receive damages under the Jones Act.

In recent years the courts have differed greatly in the amounts of damages given to the injured persons for the same type of damages. Much depends upon the jury in the respective case, on the political atmosphere in which the case is tried and on the energy and influence of the lawyers representing the injured persons. The problem in these cases is mostly that of equal justice before the law.

In May, when the writer published an article on "Marine Insurance Problems in the Fishing Industry," it was emphasized that "protection and indemnity insurance" covers also fines and penalties for alleged violations of foreign laws and losses which the insured may incur in connection with such laws. In the meantime, in the United States, Public Law 689, 83rd Congress was approved, on August 27, 1954. Under this Act it is provided that under certain conditions when a fishing vessel of the United States is seized by a foreign country, the vessel owners will be reimbursed by the government for fines and expenses incurred. This Act certainly will have some influence on "protection and indemnity insurance" and should make it possible for insurance companies to lower their premiums.

As long as annual insurance premiums for hull and P & I insurance combined stayed within the limits of five to six percent of the present value of the vessel, few serious complaints as to the premiums occurred. However, things have gone out of bounds. In a pamphlet "Crisis in the Fishing Industry," published by Everett S. Allen in 1953, the insurance rate at Provincetown, Mass., for a dragger employing 10 to 12 men, is stated to be $4,500 per year. The same publication mentions that a large Boston trawler with a crew of 17 men pays from $7,500 to $12,500 solely for a "P & I policy of $350,000." The story of the development of insurance rates on a New England scallop vessel is told by Eli G. Braley, President-Treasurer of Hathaway Machinery Company, Inc., as follows:

"In 1951, P & I insurance premiums amounted to $1,700, at a cost of about $150 a crew member, met by four notes of $450 each. In 1952, premiums amounted to $2,900, approximately $260 a man, paid by four notes of $750 each, and in 1953, premiums had risen to $4,500, a cost of more than $400 a man."

An attempt was made recently by the Seafood Producers Association of New Bedford and by the Federated Fishing Boats of New England and New York, Inc., to collect data on insurance premiums levied and payments made. The results of this survey as far as the number of answers and cases reported are concerned, were not very encouraging. Excerpts follow of some of the answers which were received by the organization involved. These refer to the year 1953.

1. The owner of a 65 ft. trawler in New England paid for the vessel, valued at $20,000, a premium of $1,200 for hull insurance, and $850 for P & I insurance, limiting the liability to $50,000.

2. The owner of an otter trawler of 74.5 ft. paid $4,000 premium for hull insurance for the vessel valued at $60,000 and $1,400 for P & I insurance, in which case the liability was limited to $150,000.

3. The owner of an otter trawler of 92 ft. paid $4,050 hull insurance premium for a vessel valued at $90,000; the P & I insurance premium was $3,000 with liability limited to $150,000.

4. The owner of a new scallop dredger in New Bedford of 109.6 ft. paid a combined hull and P & I insurance premium of $6,695.45. The vessel in this case was valued at $40,000 and the liability under the P & I was limited to $100,000. In this case a deductible clause of $500 was stipulated.

b. The owner of another scallop dredger in New Bedford of about the same size paid $2,375 for hull insurance for the vessel valued $25,000 (this vessel would cost $100,000 new). The P & I premium in this case was $4,500 with liability restricted to $100,000. A deductible clause of $500 was included in this case.

6. Owners of two trawlers of 96 ft. length each in Boston gave the following report: They paid $9,800 premium for an assumed value of $150,000 and $5,500 for P & I insurance, with liability limited to $130,000.

The owners of the vessels mentioned have reported greatly varying damage experiences. The two Boston trawlers had two small damage cases in which no settlement was reached despite the fact that the cases have been pending for over a year. Two otter trawlers in New Bedford reported no damages at all. One trawler in New Bedford reported damages of $1,400 to the propeller and $500 personal damages. Both damages were paid by the insurance company. One scallop dredger in New Bedford reported three claims totaling $9,000 not yet settled after two years had passed since the claims were made. Another scallop dredger reported a claim of $65,000. This claim was not yet settled at the date of reporting which was nine months after the claim was made.

It may not be easy to find a solution or an improvement of the present boat insurance situation. Some large insurance companies of North America have refused to accept P & I insurance in the fishing industries; in Boston there are only one or two insurance companies left that will do so. However, a few vessel owners in Boston are able to obtain insurance at satisfactory rates for their vessels and this is probably due to the strict safety rules applied by these vessel owners.

When a situation arises where vessel owners in one port can obtain insurance at reasonable rates while other vessel owners cannot, insurance becomes a competitive problem among the members of the fishing industry themselves. In such a case it is hard for government officials to take a stand. They have to take a stand, however, when the operation of a great number of vessels is placed at a disadvantage by excessive insurance costs and when the production of fish is thereby curtailed to an extent that the position of the fishing industry is endangered. The old Roman precept for officials: "Videant consules ne quid res publica detrimenti capiat" ("The administrator should see to it that the nation does not suffer damage") is valid for us today. We must watch that no damage is done to the fisheries of the United States, as viewed from the standpoint of those who are responsible for the status of the national economy.

Introducción a los Problemas de Seguro Marítimo en la Industria Pesquera

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Abstracto

Seguro marítimo en la industria pesquera comprende dos campos de seguro: "Seguro contra el casco" y "Seguro de protección e indemnización". Han resultado muchos problemas al tratar de obtener tarifas razonables para ser cubierto en ambos campos. En los Estados Unidos, las áreas de Boston, Massachusetts; New Bedford, Massachusetts; y Tampa, Florida, son las más afectadas por estos problemas. En el Caribe, Barbados principalmente es afectado por estos problemas. Las tarifas en Boston, Massachusetts, han subido tan alto como 11 y 12 por ciento. En New Bedford, Massachusetts, se reportó un caso en el cual la tarifa subió en un 25 por ciento. En Tampa, Florida, tarifas de 10% y más, se reportan. Puesto que tarifas de seguros muy altas hacen la pesca improductiva y son causa de desempleo en la industria pesquera, es necesario encontrar medios para mejorar la situación de seguros marítimos.

Some Observation on the Insurance of Commercial Fishing Vessels

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This paper has the purpose of clarifying the problem of what the insurance of commercial fishing vessels in the United States of America means for vessel owners and crews on one side and the insurance companies on the other.

The insurance problems facing the fishing industry in the United States itself differ in important respects from one part of the country to another. Insurance problems facing the fishing industries in some of the other countries represented here today also differ, I have no doubt, from the situation in the United States of America. In illuminating points of difference as well as points of similarity, in the mutual exchange of information and views, and in the discussion of unsolved problems, the Gulf and Caribbean Fisheries Institute has an important and constructive role to play.

This paper will discuss the insurance problem in a general way, despite the dangers of generalizations. To begin with, an "insurance market" can often be a dynamic affair that changes frequently and quietly. The supply and demand for insurance are subject to frequent adjustments. Thus, not only are rates changeable but also are the number of vessels requiring insurance and the number of insurers willing to supply such insurance. A new insurer willing to provide coverage in a given area might begin, not with a

public announcement inviting all those interested to apply, but rather with the sale of a single policy in that area. The insurance company may be experimenting and to be sort of wading into the water very cautiously.

Moreover, there are variations in the "insurance market", depending on the different types of boats on which coverage is sought. For example, the nature of the insurance problem, rates, availability of insurers, etc., may differ not only regionally but also with respect to whether one is referring to shrimp boats, sponge boats, oyster boats, tuna clippers, scallop-dredgers, pogie boats, steel trawlers, wooden boats and also to whether one is referring to boats that go out only for the day or for extended periods to fishing banks. Then there are variations in the "insurance market" depending on the type of vessel ownership, that is, company owned fleets as compared to single individually owned fishing vessels.

Further, any statement to the effect that the loss experience is worse in one type of coverage than in another, e.g., worse in Protection & Indemnity (liability) coverage than it is in Hull, would have to be broken down analytically by regions. For example, on the Gulf, P & I loss experience has recently been better than the Hull experience with the reverse being true in New England.

Five months ago I began to look into this specialized field of commercial fishery insurance. Two of the earliest observations made were rather startling ones.

First, there is an absence of sales promotional material designed to get fishing vessel owners to buy insurance from one company rather than another. Insurance companies, like other types of commercial enterprise, are generally interested in increasing their sales. In many other types of insurance, life, fire, casualty, as well as marine for industries other than commercial fishing, a considerable amount of sales promotional material is put out by the insurance companies. There is an absence of any indication of eagerness on the part of insurance companies to increase their sales of insurance to owners of fishing vessels.

Secondly, the individual commercial fishing vessel owner is not cost conscious as a matter of principle. The cost control side of the fishing business becomes important to him only at a time of and in the face of diminishing business. The sudden concentration of attention within the fishing industry on the high cost of insurance is taking place during a time when the financial capacity may not be there to meet the problem fully.

The insurance of fishing vessels has to do with the seaworthiness of hulls, the maintenance of equipment, and the operation and safety at sea of vessels and crews engaged in the business of catching fish. The losses suffered by insurance companies in connection with Hull as well as P&I coverages on commercial fishing vessels have been persistently high in recent years. Particularly in the New England area, injury verdicts have gone up tremendously, as have acquisition costs, shipyard bills and other operational items. With regard to P&I losses, the courts of Massachusetts are said to have made the fishing vessel owner an "insurer" of the safety of the crew members. The vessel owner is held to an absolute warranty of seaworthiness. It has been a losing proposition for the insurance companies despite increases in premiums.

Many insurance companies have, as a result of continuous losses, dropped

out and are not selling either P&I or Hull coverage any longer. A few that have hung on have raised their premiums to a point where individual owners of a single vessel or of two or three vessels are complaining that the premiums charged are so high as to make it prohibitive as a cost item. What can vessel owners and crews do to bring accident losses down and thereby the premiums? What should be done to get vessel owners to maintain the vessel, the fixed equipment, the safety equipment, in as good condition, let us say, as the fishing gear?

Statistics on commercial fishing insurance are not easily obtained because the insurance companies have not generally separated out for publication the fishing boat figures from their marine figures generally. Rating procedures in use by the insurance companies, as will be shown later, do not put maximum weight on statistics. As a result, they have not gotten together on a consolidation of their respective records on commercial fishing boats.

From a social point of view, preventing a loss from happening is more desirable than insurance. Although insurance protects the individual against loss, society must bear the actual loss, regardless of the insurance. It follows, therefore, that from a social point of view, premium rates should be fixed high enough to encourage prevention measures by the insured.

It has been said that the best safety device is a careful man. The presence of mechanical devices should not be permitted to produce an illusion of safety. They must be efficiently maintained and operated, for all mechanical aids necessarily depend on, and may be ineffective because of, the human factor. The insurance companies may show where loss prevention efforts should be increased, but such engineering advice is useless unless the vessel owner and crew really cooperate and act on the advice. The insurance companies may offer lower premium rates for better safety conditions and demand higher rates for inferior conditions, or even refuse coverage if conditions are too bad. Thus, the insurance company can appeal to the pocketbook. They can not go beyond this. Prevention is a matter for the individual vessel owner and crew. The existence of insurance should not reduce safety precautions; insurance should not lead to a spirit of recklessness.

Insurance is based on experience; the premiums are fixed on the basis of experience. The accumulated premiums of many are the funds from which losses are paid. The sale of insurance is a sale of a promise to pay money if a loss occurs. The premium is the payment for the promise. The capacity of insurance companies to perform on their promises when called upon to do so is based on the adequacy of the accumulated premiums which are the source of funds from which the losses are paid.

Next, the hazards involved in P&I and in Hull coverage are in many respects closely inter-related and duplicate each other. Making some change in the Hull (structure) also affects the P&I side of the risk; bringing in safety equipment to protect the crew against injury also affects the Hull side of the risk. In fact, the Hull business of an insurer that is writing only Hull in any given area, is in a fundamental sense dependent on the availability in that area of insurers selling P&I. Vessel owners need both and cannot function with just one of these coverages. The Hull insurer would lose its hull business if there were no P&I insurer around to sell P&I coverage to the same vessel owner.

The hazards of fishing vessels with their close working quarters are such

that the underwriting of these vessels calls for special care. Marine insurance rates are not regulated by the supervisory insurance authorities. Classification of risks does not play a large part in rate making for fishing vessels. There is no manual of rates to which one can refer to find out what the premium rate will be for a vessel of a certain class, operating in a designated area, etc. It is a matter of negotiation between the vessel owner's broker and the insurance company. However, the insurance company does take into account the loss record and standing of the vessel owner, and also the record of premiums and losses on risks submitted by the broker. The insurance underwriter also consults records of his general experience with fishing vessels in the particular area, etc.

Some insurance companies have begun to insist on a more complete physical survey of the vessel by a competent marine surveyor, covering also fire fighting equipment, general maintenance, worth and general reputation not only of the vessel owner but also of the operating personnel, whether the venture is or has been making money, whether the owner is keeping his maintenance bills, etc., on a current basis, how the vessel is mortgaged, etc.

Some insurance companies give percentage rate deductions to a fleet based on the number of vessels in the fleet. Other insurance companies feel it is not logical to give so-called fleet credits immediately but prefer to let a fleet earn such credits by good experience. Some insurance companies are for rating purposes tending to be increasingly wary of fleet operations, feeling that a number are really single vessel ownerships banding together to form a fictitious fleet with the aim of getting preferred rating. Thus in practice, the rating methods in use are the result of experience flavored by competition and what is called within the insurance industry "judgment rating"—sort of what one might call "flair" or "feel" or intuitive insight.

Generally speaking, insurance companies issue as a basic policy form for fishing vessels, aside from any special riders they may attach, the so-called American Institute Time Hull Form, the same one that they use for large oceangoing tonnage. There has been some feeling recently within the insurance industry that the form is not stringent enough for small fishing hulls and that it was never designed for small tonnage. For P&I coverage of fishing vessels, the companies generally use the Inland Vessel P&I Form or the Ocean Vessel P&I Form, or some variant of either.

Lower premium rates prevailing in other kinds of insurance, such as workmen's compensation covering workers on land, do not suffice for P&I coverage on fishing vessels. What this means is that the loss experience of insurance companies in connection with worker's accidents on land, with, among other controls, maximum amounts for specified injuries, fixed by statute and not left to a court verdict, has been much better than the losses of insurance companies in connection with injuries to crewmen working on board fishing vessels. Therefore, pessimism on the part of the insurance company is justified and the premium should be fixed high, so that more is available to be put aside for future losses.

A fundamental principle of marine insurance is that the contract is *uberrimae fidei*, that is, one based on the utmost good faith. A basic foundation stone of insurance is that the insured act as if there were no insurance. If the utmost good faith is not observed by the vessel owner or by an intermediary (broker) employed in the transaction, the aggrieved party is entitled

morally and legally to call it "quits". In practice, a duty rests on the vessel owner, and the crew whose interests are tied with the interests of the vessel owner, and on the broker, to disclose all material facts and to make no misrepresentation on any subject related to the risk, such as would influence an insurer in considering whether to accept or decline the risk. The so-called Sue & Labor Clause which appears in every marine insurance policy means in substance that, in dealing with an accident or with a loss, the insured vessel owner should act as if he were uninsured.

I am sure you have all heard the phrase "moral hazard" in connection with insurance. The term "moral hazard" as distinguished from "physical hazard" is applied to such considerations as the character, habits, mental attitudes of the individual, etc. Moral hazards are concerned entirely with the attitude and conduct of the insured. Actually, I think it would be better and more accurate to use the term "psychological hazard" because there are mental attitudes resulting from carelessness that most decidedly contribute to a risk and yet in no sense involve moral turpitude.

The moral hazard faced by an insurance company is not limited to the personal or business ethics of the insured or to malice on his part.

There are various other aspects of moral hazard. These include such conduct as poor seamanship; disdain of training needed for proper use of scientific navigating instruments; carelessness in equipment maintenance; resorting to blind navigating in fogs; failure to pay attention to charts; maintaining the decks and the engineers rooms in bad condition; dropping cigarettes on decks where oil is in abundance; pouring oil in the bilge; using all personnel on the vessel to help bring in the net; leaving no one on watch in the engine room; allowing drunks to get on board; disinterest in and ignorance as to how the engine works; as to how to judge its performance; as to how to tune it up; as to how to replace defective parts, so that motors will not be permitted to run until they fall apart, etc.; venturing out too far, looking for new fishing banks, for new shrimp beds, staying out until the last moment despite weather conditions, etc.

Moral hazard, once its presence is observed, is not rateable and therefore is not insurable. By that, I mean that an increase in the premium is not sufficient compensation for assuming a known moral hazard. Insuring physical hazards resolves itself into a matter of securing an adequate rate for any specific risk. The premium rate is presumed to measure the physical hazard but does not give any consideration to the element of moral hazard. If the existence of a serious element of moral hazard is suspected, the insurance company can resort to "rating down the risk," that is, scaling down the amount of insurance the insurance company will provide. Thus, if the vessel is worth $75,000 the insurance company may agree to insure it only for $50,000. However, once the existence of a serious element of moral hazard is established, the insurance company has only one choice and that is to cancel the insurance and get off the risk.

The moral hazard of psychological attitude that pervades the field of commercial fishing is not an individual matter, but a group matter. It is not primarily a matter of race or nationality or culture, but rather an occupational group matter. The occupational group is one in which the individual is willing to undergo the loneliness of the open seas in a small boat. No agricultural workers, no factory workers, certainly no office workers, have

such a rough life; even a migrant worker's habitation on land is better. This is a life of great courage and self-confidence. There is a strong streak of fatalism in the fishermen's character. That very fatalism comes with it a disdain for accident prevention methods. Therefore, helping the industry to solve its insurance problem becomes a problem of reconciling these character traits with a persistent and continuous observance of safety precautions.

The problem of fishing vessel insurance is clearly not a simple one and there is no simple answer or solution. There are a number of possible measures which merit consideration by all groups concerned. A list may be useful in stimulating further consideration and discussion.

1. Commercial fishing vessels should be subject to official standards, with inspection and certification by recognized surveyors, plus a follow-up procedure. It has been suggested that fishing vessels should be brought within the purview of the U. S. Coast Guard, with a view of their complying with its construction and maintenance standards imposed, for example, on passenger and cargo vessels; e.g., as to hull, engine, installations, loading equipment, safety appliances, rescue apparatus, periodic drills in use of equipment, etc. This might be tied in with a system of industry self-regulation; that is, an industry classification system with a Government agency accepting the Industry's Certificates.

2. Some agency, whether governmental or private, should be empowered to establish and certify the qualifications for seagoing personnel on fishing vessels. Some regulations or standards should be cooperatively developed within the fishing industry with the backing of Government enforcement of such Industry developed standards. There should be a Government regulation requiring that the master, engineer, and navigating personnel on commercial fishing vessels be licensed. If licensing were to be required, my own feeling would tend toward a limited system of licensing; that is, no licenses to new personnel without training and a qualifying examination. Those captains, masters, engineers, and navigating personnel already operating as such for years, should not be bothered. Finally, crewmen should not just be required to be competent fishermen but also competent seamen.

3. Training program for personnel: Vessel owners and crews should develop cooperatively some kind of practical group-study or discussion meeting designed to improve skills in seamanship, use of instruments, the handling and maintenance of power equipment, safety methods, proper radio procedure, etc.

4. A federal law limiting claims for each accident should be enacted. A ceiling on amounts for death and injuries should be fixed by statute. A suggestive analogy pointed to is what has been done in the field of Workmen's Compensation covering occupational illnesses and injuries on land.

5. The insurance companies should inspect and classify fishing vessels for the purpose of rate fixing in accordance with type, age, physical characteristics, etc. The insurance companies should consider the possibilities of consolidating the experience of the separate insurance companies and of making it public; of developing some plan of analytic or statistical rating, based on a classification plan or register or risks.

6. Both insurance companies and vessel owners should expand the use of policies with deductibles, so that insurance companies will not be burdened with a multiplicity of small claims.

7. Insurance companies should insist on an agreed adequate standard of safety before insuring. The insurance companies should offer inducements by lower rates on a risk where it is above the average and demand higher rates where it is below the average. This would provide a dollar incentive to observe good standards of construction and to train crews to guard the safety of vessels. Once a vessel owner gives concrete evidence that he is trying to improve the conditions of the risk, the insurance companies should aid him actively in this effort. The insurance companies should not feel that they are fully carrying out their role in cases where, having asked for and received a sufficiently high premium, they remain passive thereafter, insofar as engineering the risk is concerned.

8. Insurance companies should publish a pamphlet in all needed languages explaining in simple fashion what the obligations of the insurance companies are to the insured vessel owner and of the insured vessel owner to the insurance company. Such a pamphlet should point out the limiting terms and conditions of the policy and what these terms and conditions mean in terms of actions on the part of vessel owner and crew. Obviously, an insurance company does not always know for what it may later find itself liable. But certainly the well-established factual precedents can be brought to the attention of vessel owners and crews.

9. Insurance companies should make available periodically to fishing vessel owners a list of percentage differences in insurance premium rates for varying types of fishing vessels and also for somewhat comparable commercial vessels outside the fishing industry, to arouse the owner's interest in the possibilities of getting better rates through better maintenance and few losses. The brokers, particularly, would have to cooperate, since they play so large a part in the fixing of the agreed rate in so many cases.

10. A suggestion has been made for the setting up of a Commission to examine the whole insurance question, comprehensively and systematically, and to prepare a report with findings and recommendations. On this Commission there should be representatives of the fishermen, the vessel owners, the banker-mortgagees, the insurance brokers and the insurance companies. Such a Commission should strive to bring about an integrated approach to the insurance problem, with continuing long-range objectives. One of my impressions is that there has been neither an integrated nor a steady, persistent attention over the years to the insurance problem. The insurance problem should not be heard just during critical stages in which the fishing industry may find itself; that is to say, the Commission should try to create a framework for dealing with the problem that will do away with what has apparently thus far been a crisis approach. This Commission should work for a unity of purpose now absent, a unity among the various groups, fishermen, vessel owners, brokers, and insurance companies.

A.

The figures which follow immediately, made available by one insurance company, are a recapitulation of Hull fishing vessel statistics covering an 8 year period (1946-1953). The region included under these figures extends from the Gulf of New England, from Brownsville, Texas to Eastport, Maine.

Year	Premiums (Gross Less Returns)	Losses Paid Less Salvage	Ratio
1946	307,848	176,532	57%
1947	358,028	268,398	70%
1948	592,220	322,589	54%
1949	637,929	562,150	88%
1950	706,609	417,603	58%
1951	833,447	466,871	56%
1952	673,999	816,885	121%
1953	684,744	525,293	76%

The losses estimated and still outstanding and unpaid as of 12/31/53 were reported to be $231,672. If one adds this figure to the losses actually paid out during 1953 amounting to $525,293 the ratio of losses (incurred) to premiums is 110%.

B.

The same insurance company was able to supply a breakdown of the above figures only through 1951, and this breakdown follows:

	1946			1947			1948		
Class	Premiums	Losses	Ratio	Premiums	Losses	Ratio	Premiums	Losses	Ratio
Menhaden:									
Marine	68,867	9,217	13%	83,245	17,000	20%	136,822	52,748	39%
Fire	105	....	....	....	....	....	84	....	....
Auxiliary Schooners:									
Marine	126,383	69,030	55%	146,461	133,094	91%	212,141	161,483	76%
Fire	....	....	....	....	....	....	375	....	....
Trawlers:									
Marine	75,735	88,908	117%	74,707	98,719	132%	81,741	41,889	51%
Fire	....	....	....	....	....	....	....	....	....
Miscellaneous:									
Marine	3,978	2,027	51%	8,193	3,162	39%	14,127	378	3%
Fire	3,530	1,793	51%	3,478	5,175	149%	2,426	....	....
Shrimp & Sponge Diesel:									
Marine	17,567	5,492	31%	28,250	8,588	30%	134,038	54,193	40%
Fire	6,598	....	....	6,536	114	1.7%	4,186	245	6%
Shrimp & Sponge Gas:									
Marine	1,128	....	....	4,529	2,546	56%	6,118	2,658	43%
Fire	3,957	65	1.6%	2,629	....	....	912	8,995	986%
Totals:									
Marine	293,658	174,674	59%	345,385	263,109	76%	584.987	313,349	54%
Fire	14,190	1,858	13%	12,643	5,289	42%	7,233	9,240	128%

B (cont.)

Class	1949 Premiums	1949 Losses	1949 Ratio	1950 Premiums	1950 Losses	1950 Ratio	1951 Premiums	1951 Losses	1951 Ratio
Menhaden:									
Marine	168,785	73,629	44%	161,642	20,019	12%	176,312	22,669	13%
Fire	1,485	....	....	333	....	.	300	....	. .
Auxiliary Schooners:									
Marine	216,234	340,419	157%	200,204	168,413	84%	260,421	110,630	42%
Fire	....	. .	....	....	....	....	36	....	. .
Trawlers:									
Marine	45,185	28,432	63%	42,044	24,306	58%	23,038	41,470	180%
Fire	240	....	....	849	. .	....	....	....	. .
Miscellaneous:									
Marine	32,881	16,551	50%	48,092	4,357	9%	43,431	17,861	41%
Fire	485	....	....	1,011	....	. .	684	....	. .
Shrimp & Sponge Diesel:									
Marine	164,513	99,136	60%	244,989	179,497	73%	322,907	268,552	83%
Fire	2,950	732	25%	3,657	9,174	251%	2,527	66	2.6%
Shrimp & Sponge Gas:									
Marine	3,517	3,251	92%	2,261	4,075	180%	3,066	5,623	183%
Fire	1,654	....	....	1,527	7,762	508%	725	.	....
Totals:									
Marine	631,115	561,418	89%	699,232	400,667	57%	829,175	466,805	56%
Fire	6,814	732	11%	7,377	16,936	230%	4,272	66	1.5%

C.

The next figures to be presented summarize the experience met by an insurance company in connection with a fleet of shrimp boats operating in the Gulf. For a period of 4 years, 1948-1952, the business was very profitable; the loss ratio was very low, about 1½%, and then:

Year	PREMIUMS Hull	PREMIUMS P & I	LOSSES Number	LOSSES Paid	LOSSES Outstanding Estimated	LOSSES Total
7/25— 7/53	14,067	5,100	1	1,750	....	1,750
7/53— 7/54	14,211	5,049	4	30,000	37,000	67,000
7/54—10/54	5,190	1,393	3	....	60,000	60,000
Total	33,468	11,542	8	31,750	97,000	128,750

D.

On New England Hull business, one insurance company told me that on steel trawlers, during the period 1949-1953, its average loss ratio on gross premiums, that is before deducting expenses and commissions, was 99.9%; on wooden fishing boats its loss ratio was 91.9%.

About 50% of the ocean marine Hull business originating on the Pacific Coast of the United States relates to fishing vessels, most of it on tuna clippers. The following resumé of premiums and losses as of 11/30/53 was compiled by the Pacific Coast Hull Association from figures supplied by member insurance companies of that Association.

Year	Commissions and Returns Premiums Less	Including Outstandings Losses Less Recoveries	Ratio Loss
		WOOD	
1948	$1,241,149.25	$ 967,231.33	77.39
1949	1,323,187.67	1,278,431.03	96.62
1950	1,464,184.05	1,263,844.99	86.32
1951	1,727,851.27	2,473,373.57	143.15
1952	1,584,893.34	1,982,006.60	125.06
1953	532,952.20	525,847.14	98.67
	$7,874,217.78	$8,490,734.66	107.83
		STEEL	
1948	209,912.02	55,412.64	26.40
1949	248,223.54	11,482.35	4.62
1950	272,440.94	176,273.70	64.70
1951	297,385.29	99,824.61	33.57
1952	366,678.59	712,413.66	194.29
1953	160,344.56	53,130.52	33.13
	$1,554,984.94	$1,108,537.48	71.29
		WOOD AND STEEL	
1948	1,451,061.27	1,022,643.97	70.48
1949	1,571,411.21	1,289,913.38	82.09
1950	1,736,624.99	1,440,118.69	82.93
1951	2,025,236.56	2,573,198.18	127.06
1952	1,951,571.93	2,694,420.26	138.06
1953	693,296.76	578,977.66	83.51
	$9,429,202.72	$9,599,272.14	101.80

Algunas Observaciones Sobre el Seguro de Barcos Pesqueros Comerciales

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Abstracto

El abastecimiento y la demanda por seguro para botes pesqueros, están sujetos a frequentes ajustes, dependiendo sobre el número de tipos de botes que requieren seguro. Hay una falta de propaganda en el caso de seguro para botes pesqueros, en contraste con otros tipos de seguro.

Los dueños de botes pesqueros no parecen comprender los costos de seguro hasta que la industria está deprimida. El costo del seguro está relacionado con el valor del casco, mantenimiento del equipo y la seguridad de operación del bajel. Las pérdidas han sido grandes debido a negligencia de parte de los dueños y la tripulación, y ésto ha causado una elevación en las tarifas. Standards para los barcos, inspecciones periódicas y entrenamiento de las tripulaciones son deseables y reducirían las pérdidas así como las tarifas de seguro. Se necesitan leyes para limitar los reclamos por accidentes individuales.

Labor Accident Law of the Republic of Cuba and Its Application to the Fishing Industry

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History and Origin of Workmen's Compensation in Cuba

The first Workmen's Compensation Law enacted in the Republic of Cuba dates back to the year 1916; from the very beginning it was one of the most complete and advanced Workmen's Compensation laws in the world.

The Republic of Cuba by complying with the international agreements derived from the Conferences held by the International Labor Office in Geneva, made very rapid progress in favor of the Cuban working classes, progress that most countries have not achieved during a large number of years.

In Anglo-Saxon countries, long before the enactment of Workmen's Compensation Legislation, they had in their common law what was known as Employer's Liability; a rudimentary Workmen's Compensation for accidents incurred during working hours. With the progress and modernization of industrial methods during the machine age, the frequency of working risks was increased and the simple benefits of the Employer's Liability Laws were not sufficient to cope with the new situation. Thus the beginning of specific Workmen's Compensation legislation; Employer's liability laws were in some instances completely rescinded and in some others they were not, but its application became less frequent.

In our Republic, we do not have conflicts between Employer's Liability

and Workmen's Compensation laws. From the very beginning we had a definite Workmen's Compensation law, which as stated before was quite complete and very modern.

Modifications and Present Status

The basic Workmen's Compensation Law enacted in Cuba in 1916 was completely revised and modified in the year 1933 and 1934 by several Decree-Laws. Among the major modifications introduced in the present law are the following:

To include professional sicknesses such as:

Poisoning from lead, its alloys or compounds.

Poisoning by mercury, its amalgams and compounds.

Carbuncular infections.

Silicosis, with or without pulmonary tuberculosis, provided that the silicosis is the determining cause of the disability or death.

Poisoning from phosphorus and its compounds.

Poisoning from arsenic or its compounds.

Poisoning from benzene or its homologs, its nitrous and aminic derivatives.

Poisoning from halogenous derivatives of fatty hydrocarbons.

Pathological disorders due: a) to radium and to other radioactive substances, b) to X-rays.

Primitive epitheliomas of the skin.

Tabaccosis.

There is no waiting period; the injured workman starts drawing the benefits of the law from the very first day he becomes injured.

Minors under eighteen years of age have the same rights as adult workers.

All types of accidents are covered by the Workmen's Compensation Law, with the exception of Acts of God or *force majeure.*

Complete medical assistance is given to the injured workman who has the privilege of choosing physicians and hospital.

Indemnizations are of four types:

a) Temporal or *per diem* allowance; that is, half of the salary drawn on the date of the accident if he has fixed daily salary, or half of the average of the salary drawn during the last sixty days if he has intermittent, variable or piece-work salary. The minimum per diem allowance is $0.50 per day. The per diem allowance may be received for a maximum period of one year.
b) For partial permanent disability the workman is entitled to one half of the diminution he has suffered in his full capacity for work, payable either as a lump sum, in which case it will be three times the total partial disability corresponding to one year, or a monthly pension for life.
c) Total permanent disability has to be paid, as a monthly pension for life, on the basis of two thirds of the annual salary.
d) In the case of death, the workmen's legal widow and children derive monthly persions according to scale, based on the number of children surviving. If there are no surviving widow or children, then the parents and collaterals may derive monthly pensions, which in the

case of parents may be for life and in the case of brothers, until they become twenty-one and for sisters until they become twenty-one, or before, if they are legally wed. The pensions for brothers and sisters may be for life, if one happens to be physically or mentally disabled to work.

Total and partial disabilities are determined by physicians according to tables. Claims can be established with or without the intervention of a Court of Justice and the Workmen's Compensation Law has been widely interpreted and supported by Supreme Court rulings.

Workmen's Compensation is compulsory in the Republic of Cuba. All employers operating within the limits of the Republic of Cuba, are obliged to insure their employees against the perils of accidents and professional sickness under the Workmen's Compensation Law. They have the choice of either using a fully authorized Workmen's Compensation Insurance Company, which, to operate must obtain a license and deposit with the Treasury Department of the Republic of Cuba a guarantee of $100,000 either in currency or in Government Bonds, or the employer may assume the risk himself, but must first secure the authorization and also deposit the $100,000 guarantee. I do not know of anyone doing so. There is no competition by Municipal, Provincial or Government Insurance, as by Article No. 65 of the Constitution, Workmen's Compensation Insurance shall only be written by private stock companies.

Premiums on Workmen's Compensation Insurance are payable on percentages calculated on the basis of the total pay roll including all types of wages paid, the sole exception are private owners and their close relatives working on what is known as family basis, that is without retribution, because they room and board with the owner. The rates are promulgated according to statistics by the Commission on Premiums for Workmen's Compensation which is a committee formed by members of Insurance Companies, owners' associations, and delegates from the Ministry of Labor.

Workmen's Compensation as Applied to the Fishing Industry

Fishing itself is precisely covered by Title IV of Workmen's Compensation Law, which says:

ARTICLE XL. "For the purpose of this law all persons composing the crew of a vessel or aircraft, or who are carried on the roll thereof, shall be considered workmen, provided said vessel or aircraft is registered under the Cuban flag and said persons are paid wages or compensation.

The charterer of the vessel or any other person or company which directly profits by its operation shall be considered as employer of the business.

In case of accident or death, the indemnification and other rights to which sea men are entitled shall be regulated by the provisions of this law."

Comments: There is no difference between sailing, motor boats or motor vessels as long as they use workmen and they receive wages or any other type of compensation, such as those peculiar to fishermen, that is a proportionate division of the whole catch after deducting all expenses of the trip and the maintenance of the vessel. Furthermore it is customary in fishing schooners that the repair of sails, mast and

painting of the vessel is done by the same crew, while they are in port and it also includes all accidents derived from this type of work, since the crew at all times are registered in the roll and therefore are employees of the owner or company that directly profits by the operation of the vessel.

ARTICLE XLI. "If the vessel is lost or six months elapse without any news being reecived regarding it or the members of the crew, the indemnification to which this law refers shall be demandable as if in case of death."

Comments: By this Article, special regulation is established whereby the lack of news during the period of six months is considered equivalent to a total loss of the vessel and all its crew.

ARTICLE XLII. "The Captain or Employer must prepare the proper reports when an accident arises by reason of work aboard his vessel, setting forth the circumstances of the case, in accordance with the provisions of Article XXVII of this law.

If there is a physician aboard, his intervention shall be requested in preparing the report and in the issuance of the proper certificate.

In case of an accident during navigation, the period of 24 hours fixed by this law for reporting the accident shall be counted from the arrival of the vessel at any Cuban port, or at a foreign port where there is a consular or diplomatic representative of the Republic, who shall present himself aboard, in order to comply with the obligation fixed for Municipal Judges in these cases."

Comments: By Article XXVII of the law the employers are obliged to communicate to the Municipal Court within 24 hours of any accident occurred during the working days, this is fulfilled by the Captain of the vessel and as the fishing trips most of the time start from and return to Cuban ports, then the 24-hour period for advising the Municipal Court is counted from the time that the vessel returns to port.

I would like to mention the fact that I do not know of any other Workmen's Compensation Law which contains the regulations referring to aircraft operations. This I point out to show that the Cuban Workmen's Compensation Law is so modern that in its original draft air navigation is covered.

The above refers exclusively to the art of fishing, the marketing and industrialization of fish are also covered by the Workmen's Compensation Law under general caption of mercantile enterprises and industrial plants.

The official tariff of Workmen's Compensation rates have the following items for the industrialization of fish:

Item No. 171	Tinning (excluding the manufacture of the tins)	2.00%
Item No. 373-a)	Retail selling of fish	2.00%
Item No. 373-b)	Curing, smoking and packing	2.00%
Item No. 373-c)	Wholesale imports (fishing excluded)	1.50%
Item No. 349	Oysters, cleaning, selecting and packing, (fishing excluded)	3.00%

As information the rates for fishing are:

Item No. 342-g	Renting of boat and/or motor boat, for fishing	8.00%
Item No. 372	Fishing operation either by schooners or motor vessel	7.00%

There is only one point that I would like to submit before finishing.

We have stated clearly that Cuban Workmen's Compensation Law applies only to vessels registered under the flag of Cuba. The question arises consequently, in the case of foreign cargo or passenger vessels, whether workers are protected by the Workmen's Compensation Law of the country under whose flag the vessels navigate. This interpretation emanates from the International Code of Law promulgated at the Sixth Pan American Conference held at Havana on February 13th, 1928, under the Presidency of late Dr. Antonio Sánchez Bustamante, a native of Cuba and a prominent international lawyer. This international Code of Law has been approved by fifteen Latin American countries.

Ley de Accidentes del Trabajo de la Republica de Cuba y su Applicación a la Industria Pesquera

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Abstracto

1. Historia y origen de la indemnización para trabajadores en Cuba.

Se hace un breve resúmen del origen y datos históricos sobre la indemnización de trabajadores, desde que se puso en efecto en la República de Cuba en el año de 1916.

2. Modificaciones y estado presente.

Información acerca de las modificaciones que se han introducido a la ley original y cuales son las regulaciones actuales.

3. Aplicación a la industria pesquera.

Información relacionada con la aplicación específica de la indemnización para trabajadores en la industria pesquera, tanto al arte de pescar como a la despensa e industria del pescado.

Insurance of Small Boats in the Barbados, B.W.I., Fishery

Dudley W. Wiles

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As a result of a loan scheme which allows a boat-owner to make small loans from the Government of Barbados for the building, repairing or refitting of his boat, it was found necessary to back these loans with an insur-

ance scheme which would offer the Government additional security, along with a mortgage on the boat for the loan enjoyed.

This insurance scheme was started in 1949 and some sixty fishing boats were covered by marine insurance for the first time in the history of the island. In that year and the next, the rates were 4% and 5½%, for 10 and 12 months fishing respectively.

Losses resulted in rates rising from 5% to 6% and from 5½% to 7½% in two years. Unfortunately, losses still occurred and so the insurance brokers were forced to again increase their rates by a further 2% in each bracket.

In 1951 when Barbados was hit by an unusual sea wave on December 3rd, the insurance claims exceeded $11,000. Again this caused the rates to be increased, until they are now 12% and 15½%.

The types of boats are the chief reason for this high rate, since some 97% are sail type boats of 22-24 ft. with inboard ballast. The answer to this is a gradual turnover to small type powered boats.

Insurance for the small type powered boat is 7%. Losses of power boats have cost the brokers $3,000 and have prevented a reduction in the rates for powered boats.

Seguro para Botes Pequeños en la Pesquería de Barbados

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Abstracto

Como resultado de un sistema de préstamos el cual permite al dueño de un bote hacer préstamos pequeños del Gobierno de Barbados para la reparación y construcción de su bote, se encontró que era necesario apoyar estos préstamos con un sistema de seguros que ofrecería al Gobierno seguridad adicional junto con una hipoteca sobre el bote por el préstamo gozado.

Este sistema de seguros se inició en 1949 y más o menos 60 botes pesqueros fueron cubiertos con seguro marino por primera vez en la historia de la isla. En ese año y en el próximo, los precios fueron 4% y 5½% por 10 y 12 meses de pesca, respectivamente. Desafortunadamente las pérdidas siguieron ocurriendo y los agentes de seguro se vieron forzados otra vez a subir los precios por 2% más, en cada rama.

En 1951 cuando Barbados fué azotada por una ola marina el 3 de Diciembre, las demandas de seguros excedieron $11,000. Nuevamente ésto causó que las tarifas subieran hasta el punto en que se encuentran ahora al 12% y 15½%.

Los tipos de botes son la razón principal por este precio alto, puesto que más o menos 97% son botes de vela de 22-24 pies. En repuesta a esto se está inclinando ahora hacia botes pequeños de motor, para los cuales el seguro es 7%.

Pérdidas de botes de motor pequeños le cuestan a los agentes de seguros $3,000 y esto ha prevenido una reducción en las tarifas.

The Fisherman and His Insurance

John S. Robas

President, Stafford Shoal Corp., Fernandina Beach, Florida

Any discussion of marine insurance should start by first establishing the frame of reference in which the discussion is presumably to be confined. Any given problem has manifold aspects, depending on whether you are an underwriter, agent or vessel owner.

The writer speaks as a consumer of insurance, and owner of a menhaden purse-seiner fishing the east coast of Florida. As such a consumer, the writer's technical knowledge of insurance is limited and the following remarks should, therefore, be interpreted liberally and in the broad sense. Since marine insurance is a technical business, sweeping generalizations may be made which will cause underwriters to cry out in anguish. However, there are few vessel owners who are interested in the technicalities of the trade; their interest and primary concern is in the broader aspects of the protection available to them through insurance.

First, what are the risks to which a fishing vessel owner is exposed—excluding the risk of going broke because of weather or market conditions:

1. He can lose his vessel at sea or damage its hull or machinery severely.
2. He can be sued by crew members for injuries sustained while in his employment.
3. He can be sued by third parties who come aboard his vessel but are not members of the crew, i.e., "lumpers" or un-loading crews.
4. He can suffer damages resulting from the operation of his vessel, such as collisions, damage to wharves and buoys, etc.
5. He can suffer a host of smaller aggravations and expenses because of the operation of his vessel or because of the neglect of his Master.

For each of the risks listed above there is an appropriate type of insurance available to protect the owner:

1. Hull insurance, with or without machinery protection.
2. Protection and Indemnity insurance—so-called P and I—which immunizes him against damage suits for injuries to crew members and from a host of minor sources of loss, including certain collisions and injuries to un-loading crews.

There are a variety of hull insurance "forms" available to the buyer. The selection of the proper hull form is important and the choice between the American Institute Time Hull Form, the Inland Vessel Form, with endorsements, or the Menhaden Form should be made only after careful consultation with the agent. The writer recommends the American Institute Time Hull Form, complete with "Inchmaree" or machinery clause. This form, while not the cheapest available, seems to offer the best all-round coverage to the vessel owner.

For the present discussion it is assumed that the average fishing vessel owner is not the type who studies his policy carefully and seeks to interpret the technical phraseology. How can such an owner assure himself that he is prudently purchasing the right insurance from the right underwriter? A few basic suggestions might well be in order:

1. Select an agent to handle your business who is a specialist in marine fishing vessel insurance; a firm specializing in tug-boat insurance is preferable to a firm whose major effort is in the life insurance field. There exist firms who specialize in marine insurance for the fishing industry and in the long run they will serve the owner better.
2. Request that your agent advise you of the underwriters with whom he intends to place your insurance; if you are ultra-conservative, ask your banker to check the underwriters for you, particularly to assure that they are licensed to do business in your State.
3. Determine through inquiry among friends in the industry how the underwriters in question have settled claims in the past. Remember that insurance is worthless to you until you are in trouble. If, when you are in trouble, you have to sue the underwriters, the court may well award you your claim—but you will be getting your money the hard way.
4. Keep in mind that a good sea-worthy vessel under good management can always be insured at a price you can afford. If the inquiries you make seem to indicate the underwriters under consideration are slow, difficult to deal with and niggardly in their settlements, advise your agent that they are unacceptable.
5. Look at the other side of the coin: don't expect any underwriters to insure a sloppy, poorly-maintained vessel with a poor captain. Remember that you have a continuing warranty to the underwriters to keep her seaworthy, even though the underwriters surveyor may have passed her when the policy was first written.
6. Avoid excessive "shopping around" for insurance—insurance markets are just as sensitive as shrimp markets. If four or five brokers are busy selling the same load of your shrimp you can expect a soft market to result; the same principle holds true for insurance.
7. Don't buy your insurance on price alone, for an energetic agent can supply a policy tailored to suit almost any purse—but he will do it by deleting protection clauses which may be badly needed when an accident occurs. Stick to a standard hull form and make the "deductible" as high as you can afford.

What does the owner, with suitable hull insurance, do when his vessel gets into trouble? A few suggestions on procedure seem necessary:

1. If you have a damage claim, and not a total loss, do everything you can to get the vessel to a safe port and to hold down the damages. Govern your actions as though you had no insurance.
2. Advise your agent immediately of the time, place and nature of the casualty so that he may make arrangements for inspection and notify the underwriters. If the damages are severe you would be wise to retain a qualified marine surveyor to represent your interests and advise you. Most policies reimburse you for this expense.
3. Obtain sworn statements, called "protests" in the trade, from your captain and crew detailing exactly how the accident occurred. If a machinery breakdown is involved, try to pin the accident to its original cause, i.e., water-pump failure, fuel pump, drive shaft sheared off, etc.
4. Remember that the insurance underwriters undertake to reimburse you

for expenses you have incurred, that is, *you* make or have made, the necessary repairs and then submit the paid bills, along with the sworn statements of the crew, to the agent who forwards it to the underwriters. The underwriters themselves do not undertake to repair your vessel for you—that is your job.

5. Forget the common notion that when your vessel is in trouble that she automatically "belongs" to the underwriters and that they should attend to towing her to port, having her dry-docked or repaired. The vessel belongs to you and you should provide for her safety and welfare as if you were uninsured.
6. Keep your claim clear-cut and honest and you will generally be paid promptly—or what passes as promptly in the insurance business. Remember that the underwriters are far more adept at spotting "padding" in a claim than you are in padding the claim—they have been in the business longer and have been padded by experts.
7. If, after all this, the underwriters refuse to honor your claim (as they sometimes do), retain the best Admiralty lawyer you can get, but only as a last resort.

Last year, through negligence of an engineer, we had a serious accident with our heavy duty main engine. The damage was so severe that preliminary repair estimates for shipyard work came to $25,000 with indications it might go higher. After a great deal of negotiation the underwriters agreed to settle for $20,000 in cash, which was better than repairing the original heavy engine. The damaged engine was removed and a new medium speed V-type engine of slightly less horsepower installed. We came out of the accident well-satisfied, but about eight thousand dollars out of pocket. However, the settlement was advantageous not only to us but to the underwriters as well. The transaction required about five months to consummate owing to the nature of the settlement.

If your hull insurance is in order it would be advisable to examine your position with regard to liability for damages due to injuries to the crew. You warrant to your crew that the vessel is seaworthy in every respect and further guarantee to keep the vessel in seaworthy condition in every respect. If a man is injured or lost on your vessel, a whole chain-reaction of complications sets in and your vessel may be un-seaworthy by respect of a faulty shackle on the topping lift, or some other minor component. She may be perfect in every other respect and unquestionably seaworthy, but if the shackle broke and caused the boom to fall on Captain Casey—you'd better have P and I coverage or Casey is liable to lower a legal boom on you.

Before going into the question of liability for crew injuries a word about the history of such claims might be interesting. Many years ago the crews on merchant vessels were tough and the owners and officers tougher. In those days if a man got sick on board, or hurt, the first mate tried to patch him up. The result was the man either went over the side with a couple of shot at his feet or was dropped in the first port to fend for himself. Occasionally, to everyone's surprise, the seaman recovered and continued work.

The result was legislation to protect the merchant seaman, which went to the opposite extreme and made the seaman virtually a member of the

owner's family. A sage has remarked that "The seaman is the ward of Admiralty law" . . . and it is apparently true. The result is the Merchant Marine Act of 1936, the so-called Jones Act, which, as far as crew injuries are concerned, merely states that the seaman has a right to have his claim against the owner heard by a jury and in such action the rules applying to railroad employees shall also apply to seamen.

This is innocent enough on the surface, but the Jones Act has been stretched to the point where damages were assessed against a ship-owner when one crew member assaulted another during a voyage. The injured seaman claimed that the vessel was un-seaworthy by virtue of an unruly crew member—and, to the owner's dismay, the jury agreed.

If a crew member regularly employed on your vessel is injured in a barroom brawl, you are legally liable for his hospitalization, maintenance and cure, although it is doubtful that he could sue you for damages. Recently, in New England, a trawlerman was awarded $25,000 for damages for the loss of a thumb. Similar cases arise every day. The New England situation is acute and sympathetic juries have handed out some staggering awards. The underwriters have countered by raising their rates for Protection and Indemnity insurance to a point where it now costs about $7,000 per year to put a 10-man trawler crew to sea.

Last year a New York firm of attorneys advised the writer that an ex-employee of his had allegedly contracted tuberculosis aboard his vessel, and could this matter be settled quietly, out of court? The writer said no, thank you. Some ten days passed and one morning the Federal Marshal handed the writer an impressive document which indicated that the New York attorneys felt that their client's feelings would only be assuaged by seventy-five thousand dollars. It was only when the writer called his agent to notify him of this situation that he learned that it was no laughing matter, and that the underwriters had already paid off on several such claims. The underwriters retained the best Admiralty lawyer in the area and took over the owner's defense. Had the suing crew member undertaken to libel the vessel the underwriters would have arranged a bond so that fishing could continue. In the end the matter was probably settled out of court.

One of the fine provisions of your P & I policy is that it provides for your defense. In Workman's Compensation insurance and other types of similar protection it is necessary to defend yourself, retain attorneys, etc., to the detriment of your regular business.

If a crewman in your employ is injured first make every attempt to see to his welfare and safety. Then notify your agent of the injury and refrain from any statements or communications on the matter except to your agent or the underwriter's attorney.

We mentioned previously a parallel between P & I insurance and Workman's Compensation. Some owners have covered their crews with Compensation insurance in the misguided belief that all parties were thus adequately covered. Workman's Compensation is certainly desirable for men working on shore or in the packing house, especially when reinforced by Longshoreman's and Harbor Workers Insurance. However, a crew member covered by Compensation insurance can settle an injury claim with the owner for, say, $1000 and give him a written release. The injured crew-

man can then institute suit under the Jones Act for any sum that a sympathetic jury will award him.

Under present legislation the owner's only worthwhile protection for vessel crews is his P & I insurance. It is not only better, but cheaper than Compensation. Based on a rate of 4 per cent of the payroll, Workman's Compensation for a three-man crew of a Campeche Bank shrimper might run $800 per year, whereas the same three men can be covered with a comprehensive P & I policy for approximately $375 per year—and this will protect the owner up to $50,000 in any one accident. Naturally, if claims and awards go up as they did in New England then this economical rate will rise sharply.

The solution to adequate, reasonable treatment for owner and crewman alike seems to lie in legislation to bring into being a Seamans Compensation Act which applies either to commercial fishing vessels alone or to all merchant seamen, including fishermen. Since merchant seamen have strong unions who have struggled for fifty years to achieve the present status of the law, it would seem most practical to seek legislation applying solely to fishermen.

Such a law would be merely an extension of shore-side Workman's Compensation legislation with special consideration for the problems and hazards of fishermen. With maximum benefits stipulated by law it would be relatively simple for underwriters to offer adequate protection to the crew at a price the owner could afford. In the South this problem is not critical as yet, probably due to the average Southerner's aversion to legal proceedings. The problem has reached critical proportions in New England. In some ports, owners have gone out of business or moved their vessels north to Canadian ports because soaring insurance rates, coupled with foreign market competition, have forced them to do so.

In summation, an owner can still afford adequate insurance coverage for his hull and machinery and he can still, in the South, obtain relatively cheap Protection and Indemnity insurance. With this coverage he can generally avert serious financial damage and can confine his worrying to market conditions and to the next payment on his vessel.

Un Pescador y su Seguro: Un Caso Histórico de Seguro Contra Casco, Protección e Indemnización

JOHN S. ROBAS
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Abstracto

El costo creciente de seguro de protección e indemnización, así como el seguro de casco y maquinaria, representa un gasto enorme para el dueño del bajel. El autor relata de su propia experiencia un caso de demanda por severos daños en la maquinaria y su reacción a una demanda de $75,000 por un miembro de la tripulación que contrajo tuberculosis. Se hace mención de los problemas en tratar de poner los pescadores debajo de la ley de indemnización para trabajadores y también se mencionan las responsabilidades legales del dueño de la embarcación pesquera.

Fishing Vessel Insurance in Norway

PETER BOE

Fisheries Attaché, Norwegian Embassy, Washington, D. C.

A modern fishing vessel represents a large investment; it is therefore of primary importance to the fisherman that he gets satisfactory insurance to cover the risks involved in operating the vessel. If not, it would be extremely difficult to obtain reasonable long term credit for building and operating costs.

In Norway there are today around 100 companies where one can obtain insurance for fishing vessels. Many of them are small mutual associations working locally, but in recent years joint stock companies too have been doing this type of business. The mutual associations working within a limited area have the advantage of intimate knowledge of the local fish industry and the participants are all interested in keeping the association working with smallest possible costs.

Operating as mutual associations and limited to local business, most of the associations have not had opportunity to build up funds. As larger motor vessels started to be more common, it was felt that some sort of cooperation between mutuals would be of benefit, since it now seemed that the risks involved in insuring one hull was too great for the smaller associations. Through a system of re-insurance the participants could spread larger liabilities so that the financial position of associations involved would not be jeopardized in event of a catastrophe. After discussion between the Government and the fishing industry, the Norwegian Government in 1933 decided to organize the Norwegian Reinsurance Institute with a grant of $150,000 as initial capital. It has been in operation since then, without any additional grants from the Government; charging the premiums have been sufficient to pay all the costs and building up additional funds.

In 1950, 42 mutual associations were working with the institute insuring 8139 vessels valued at 30 million U.S. dollars. The joint stock companies giving insurance to fishing vessels are mostly Marine insurance companies which were started to cover the need for insurance of the merchant marine. As they have experience in this field it has become natural for these companies to extend their services to the fishermen. Official approval through the medium of the Insurance Board is required for both types of companies. An act of 1930 clearly defines the relationship between the two parties to an insurance contract.

Both mutual associations and joint stock companies are issuing their insurance policies according to the rules laid down in the general statutes of Norwegian Marine insurance plan of 1930. This plan is very detailed. Some of the provisions are as follows:

Compensation for damage of the hull:

Iron and steel ships:

Age up to 15 years	no deduction
Age up 15 - 23 years	1/6th deduction
Age over 23 years	1/3rd deduction

Wooden and composite ships:

Age up to 4 years	no deduction
Age 4 - 8 years	1/6th deduction
Age over 8 years	1/3rd deduction

Compensation for damage to machinery:

If the damage is due to sinking of the ship or if it has been caused by collision, earthquake, explosion outside the machinery, or fire:

Age up to 7 years	no deduction
Age 7 - 15 years	1/6th deduction
Age over 15 years	1/3rd deduction

If the damage is attributable to causes other than those stated above:

Age up to 5 years	1/4th deduction
Age 5 - 10 years	1/3rd deduction
Age over 10 years	1/2 deduction

The amount of insurance is as a rule fixed after the underwriter has made a survey of the vessel. Most of the underwriters issue insurance for the total value of the vessel.

It is also possible for the fishermen to get insurance covering their gear and expected catches. The fishing gear as a rule is only covered by the insurance as long as it is stored on the vessel and not while in operation.

However, some mutual associations have recently started to underwrite damage and loss to fishing gear during operation. With this type of insurance the owner usually must be responsible for 20 --30 per cent of the actual loss or damage.

Marine insurance does not customarily cover war risks. However, during the last world war, the Norwegian Government set up a special insurance system covering war risks for the country's fishing fleet.

Seguro de Barcos Pesqueros en Noruega

PETER BOE

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Abstracto

En Noruega hay más o menos 100 compañías que aseguran barcos pesqueros. Muchas de éstas son pequeñas de seguro mutuo. Los riesgos mayores son esparcidos por un sistema de reaseguro del Norwegian Reinsurance Institute, organizado en 1933 con una concesión de $150,000 del Gobierno. También es posible que el pescador obtenga seguro para su equipo. En la mayoría de los casos el dueño tiene que ser responsable de 20-30 por ciento del daño actual si el seguro incluye pérdidas cuando el equipo está en uso.

DISCUSSION

Economic Session

Discussion Leader: Arne Suomela

Discussion Panel: L. C. Ringhaver, John F. Linehan

An Introduction to the Problems of Marine Insurance in the Fishery Industry

R. Kahn

Q. Suomela: Dr. Kahn, you described the insurance situation in some areas of the United States as satisfactory and other areas as unsatisfactory. Can you explain the difference?

A. Kahn: It is a question of personalities, which play an important part in the insurance situation—personalities in the fishing industry on one side and personalities in the courts on the other. In Texas, in New Orleans, and in the Gulf coast areas insurance rates are generally lower than in other areas. This is due in part to the great care which is given to the fishing vessel by owners in this area. I wish I could say the same for other areas. This makes a difference in rates. Also in Texas, the courts or juries are not inclined to respond to excessive demands for compensation in case of accidents, while in the eastern states—in Massachusetts for example—the courts and juries respond more liberally to claims in cases of accidents and sicknesses. Insurance companies, knowing of this, charge lower rates in some areas than in others.

Q. Ringhaver: How many boats constitute a fleet for insurance purposes?

A. Linehan: In New Bedford we have had several cases arise where an owner with two vessels would have the rates rise on both vessels because he had had a bad loss experience on one of them. For insurance purposes apparently two or more vessels constitute a fleet.

One reason marine insurance has so many problems and rates are out of proportion is that the fishing people do not seem to be interested in insurance. In New England we have suffered terrifically from poor insurance practice; anyone who is involved in the fishing industry should know that unless he can insure his vessels he can't even fish. In New England our principal problem today is insurance, and I think people had better become interested in it soon.

Dr. Kahn mentioned the phrase "equal justice under the law" and he went on to say that in the final analysis government officials must take a stand on important problems of insurance. Mr. Robas said that it is most important that Congress take fishermen out of the Jones Act, and place them under a Seaman's Compensation Act which would be both fair to crew members and to owners. Dr.

Kahn, what position will the Department of the Interior take on any effort that we in the industry make toward eliminating the Jones Act and writing a seaman's compensation act?

A. Kahn: Nobody could answer this but the Secretary of the Interior. The elimination of the Jones Act is easily said, but it would be difficult to do. The seaman's unions oppose such a move. Regardless of whether the Jones Act continues or not, by proper education of both the boat owners and fishermen much can be done to eliminate difficulties. Perhaps under the Saltenstall Bill we will have some money available to do educational work, for example, to train the fishermen to use proper care when using inflammable material, and to train the boat owner to have inspections of the vessels from time to time and to see that the captain is properly selected, to train the captains to take care of their vessels, etc. Such an educational movement would increase the confidence of the insurance companies, and they would come back and ask for business. The hope for lower insurance rates comes when competition among the insurance companies is revived.

Problems Affecting Fisheries Marine Insurance on the Atlantic and Gulf Coasts of the United States

JEROME SACHS

Q. Suomela: Mr. Sachs, you said that marine insurance premiums in the United States are not fixed by the regulatory authorities. Should fishing vessel owners try to work out a solution of their insurance problems by use of some sort of mutual group self-insurance scheme on a cooperative basis? Could the Department of Commerce give them advice on such possibilities?

A. Sachs: It should be possible for the vessel owners to get together to set up a system of mutual self-insurance. However, such a system would have to be operated subject to certain definite limitations on its undertakings of risks. Such a system would obviously not do away with the difficulties now present, but such a scheme might be useful in providing a means whereby the vessel owners themselves could take an active hand in group self-correction of underlying difficulties and hazards. I think that such a group scheme should involve the use of deductibles, that is, the group should think in terms of taking care of or self-insuring the first claims and of placing the excesses with the insurance companies. As a matter of fact, the so-called "Clubs" in the London marine insurance market developed in this way. Originally, Lloyd's had not wanted to provide P & I insurance for fear it would result in indiscriminate hiring of incompetent crews, etc. To make this type of coverage

more attractive to Lloyd's, the vessel owners got together among themselves and formed these "Clubs" within which the member vessel owners insured each other on the small claims, and looked to Lloyd's for taking care of the larger claims. In summation, a mutual self-insurance system could, in theory, be developed among the owners of commercial fishing vessels. However, the nature of the hazards being what they are, the vessel owners, in practice, would have to be forthright in their dealings with each other. Since, as a group, the vessel owners would be self-insuring their own claims to the extent of the amount of the deductible, misrepresentation on claims or failure to improve the conditions surrounding the risk would simply mean that the member vessel owners of such a group would be taking unfair advantage of each other, and certainly no one should be able to spot this faster than the other suffering member vessel owners. In other words, the vessel owners singly and collectively would have to be vigilant in the screening of claims and in getting after their own members to improve the underwriting conditions.

Q. Suomela: Licensing of fishing vessel captains and engineers is related to this problem. Because of the lack of education on the part of some of the captains and the engineers they cannot even get their papers. In such cases how can the men obtain their licenses?

A. Sachs: Licensing of navigating personnel or marine engineering personnel is inevitable if any significant step is to be taken in reducing claims. The licensing procedure should, however, be applied realistically. I do not think literacy need be the conclusive factor. I have a considerable amount of respect for the judgment of men who have had practical experience; it seems to me that there must be some kind of sense of the sea which is developed out of the sheer experience of living on the sea, and having it does not necessarily involve being literate. With the view to breaking down resistance to the adoption of a licensing requirement, a license should perhaps be required only of new personnel, with licenses being automatically given to those who have already been operating for a designated number of years. Any educational techniques should not be academic in approach, but emphasize the practical. I would certainly not give anything that would set up insurmountable blocks to a man without schooling.

Q. Linehan: Mr. Sachs, you mentioned that there was no general attempt on the part of boat owners to reduce the cost of premiums, but we've been through a series of depressions, when the cost of premiums has actually tied up boats in New Bedford. Some attempt has been made on the part of boat owners of my acquaintances to reduce costs, but they have found that regardless of what they do as in-

dividuals the cost continues to rise in general with the costs to other owners. Owners who have not had any losses over a period of two or three years find their rates just as high as those whose boats have had high claims and as a result they have thrown up their hands in despair.

A. Sachs: The insurance companies are remiss, in my judgment, if they don't reduce rates for good risks and raise the rates for bad risks. Sometimes, however, the insurance companies—and it happens in all fields—will demand a high rate from an insured with a good record, because of their general "sense" of the market, i.e. the insurance company has the feeling that the general market is bad and they will insist on a high rate. In general the insurance companies, in my judgment, should not write insurance if the risk is unsatisfactory, not withstanding any pressures of brokers or anyone else, but at the same time, they should go out of their way to be helpful to those vessel owners who are showing a capacity to improve the risk.

Q. Linehan: We have discussed licensing of captains and engineers; would you advocate the examination of the crew members so that they would be qualified as ablebodied seamen before they were allowed to go fishing?

A. Sachs: The general direction should be one of increasing the skill of fishermen as seamen. With a small crew on a small boat, situations are constantly coming up requiring men to do a variety of jobs. Therefore, I would say that there should be more stringent requirements on fishing boats than on bigger vessels, where the loss of the services of one man is proportionately less crippling. For the ordinary fisherman maybe a license ought not be required, but instead a systematic persistent effort should be made to increase the skill of the crews about all kinds of marine problems, including navigating.

Q. Ringhaver: Mr. Sachs, from your information on accidents that occur, do you not believe there are more due to the negligence of the men than the safe seaworthiness of the vessel?

A. Sachs: I don't know.

Q. Ringhaver: In our experience we find that in most cases there has definitely been negligence, and sometimes we find that the same accidents will recur time and time again. Don't you believe that if the insurance companies would check into these recurring types of accidents that there could be a remedy which would involve a saving?

A. Sachs: It is apparent that there has been a lack of an integrated approach to the insurance problem. The vessel owners talk critically of the crews; crews similarly feel that most of the problems flow from the fact that the vessel owners are not keeping up their boats; the insurance companies in turn can possibly be criticized for all sorts of things that

they are or are not doing. Everyone in the industry should get together if progress is to be made. The establishment of some kind of commission would seem desirable, on which there should be representatives of the vessel owners, the representatives of the insurance companies, representatives of the brokers, and representatives of some of the banks that are active in financing the boats. A study should be made of this pressing problem on an integrated long-term basis.

Q. Wheelock: I would like to ask Mr. Sachs if he could explore in his own department the possibility of using the service of the Coast Guard in connection with vessel inspections. My experience is largely in the Navy, and I know that quality cannot be maintained without unbiased and frequent inspection. At Scripps Institute of Oceanography, the five vessels that we operate are public vessels and not subject to any inspection, yet we have asked the Coast Guard for their routine inspection. They have given that to us free, and although we are not bound by any of their requirements because of the nature of the vessels, it has been a tremendous help to us to know their attitude toward our vessels. I know also that that service is available free to private yachtsmen; I'm not sure that it is open to commercial fishermen, but I think so. It has a great advantage if they would give it free; the vessel owners would get a good inspection, and whether they did anything about it or not at least they would know what to do. How can fishermen go about getting this service?

A. Sachs: The Coast Guard is part of the Treasury Department and not of the Commerce Department, so that I'm not in a position to explore the question helpfully within my own department. If the inspection of the Coast Guard were made available to commercial fishermen, legislation would appear to be required. I think that a bill would have to be enacted in order to extend the facilities of the Coast Guard to fishing vessels. I also feel that if the Coast Guard were to enter this field that it should be more in the role of enforcing regulations and standards set up by the industry itself rather than for the Coast Guard to set up the standards and regulations. There is no reason why the government cannot enforce regulations for commercial fishing vessels, just as it does for other types, if the industry wants it. The law exists, all you have to do is to extend it to additional catagories.

Q. Galler: Has there been any systematic attempt to bring together information on the various types of accidents and casualties occuring in the industry, and to make a careful statistical analysis of causes of these types of accidents and their frequency?

A. Sachs: To my knowledge no systematic analysis has been made.

Insurance rates in this field are not regulated and there has been little dependence on statistics.

Linehan (Comment): We have been trying for a year to get statistics showing what catagories of claims were being placed. With an eye to improving safety standards we wanted to know how many claims were put in due to crushed hands, how many due to lost fingers, how many due to crushed ribs. We ran into a stone wall with the insurance companies. They will not divulge any information on what their claims are or the frequency of claims of any particular type. Since we couldn't get it ourselves we went to the Commonwealth of Massachusetts, attempting through the Commissioner of Insurance to get the information officially. He had no success. At present the Federal Reserve Bank of Boston is attempting to get some statistics.

Galler: (Comment): May I present to you for consideration experience along similar lines in other fields. Perhaps it might have some application here. After World War II, Cornell University became interested in this type of a situation as it occurs in non-commercial aircraft. They set up an organization to bring together facts from as many different sources as were available on the subject of causes of crashes and causes of injuries. These data were evaluated not only in terms of dollars and cents but in improvements in design and engineering. As a result of their efforts there has been a tremendous interest generated in the industry, which was not interested at the beginning. A similar effort being made to engineer safety into automobiles began by this same organization. They have got cooperation from the traffic bureaus and the local police authorities in various states and now the automobile industry itself is presenting information to this group which 10 years ago it would never have dreamed of giving them. So at least in those two fields there is a tremendous amount of information which is being accumulated, analyzed in terms of good practical applications, and is being turned back to the industry for its own use. Perhaps the experience of the Cornell Aerial Group might be brought into the vessel insurance situation.

Employee's Liability and Workmen's Compensation Insurance in the Fishing Industry in Cuba

ABELARDO GARCIA MENDEZ

Q. Suomela: I believe according to your presentation, Mr. Garcia, that fishermen in Cuba are subject to workmen's compensation laws. Is the workmen's compensation the same in all provinces in Cuba?

A. Garcia: Yes.

Q. Linehan: You mentioned in your paper that all claims for compensation for injury must be submitted within 24 hours after the boat lands in a Cuban port. We have a serious situation in New England where often the owner doesn't know a claim has been levied against him until six months or a year later when he receives a court summons. After the 24 hour period in Cuba, is the claim void, or what happens if he doesn't file within 24 hours?

A. Garcia: He is supposed to notify the municipal court within 24 hours of any accident occurring during working hours. Now that is the law applying to any industrial or mercantile business, but the law specifically gives a longer period of time for fishing boats. The 24 hours is for the employer to make a report when he gets back to port. If a fishing boat is out for, say six weeks in the Gulf, and an accident occurs on the first day, the captain or the pilot of the boat is not obliged to report until he gets back into a Cuban port, or if he gets back into a foreign port with a Cuban Consulate. That only applies to the report made by the employer. To take a specific example, suppose a man on a fishing trip handles a 300 pound ice block and receives a rupture. If he is not conscious of that rupture until, say after 4 months, he has the right to make a claim within a year from the day when the accident occurred.

Q. Whiteleather: Does the government of Cuba carry on any sort of an educational program in regards to safety, in the interest of reducing rates on workmen's compensation?

A. Garcia: No. The insurance companies have a chapter of the National Safety Council and through that we have been trying for the last 10 or 15 years to make our nation conscious of safety. Our biggest problems now is safety for automobile drivers.

Q. Kahn: What is the highest compensation possible in case of the death of a fisherman?

A. Garcia: The maximum payment depends on how many children the fisherman has. If he leaves a widow and one child, she will get a pension of 20 per cent of his annual salary and the child will get 30 per cent. If the widow remarries the child will be cared for until he is 21. When there are two or more children the wife still gets 20 per cent and the children will get 45 per cent, but the total cannot be over 70 per cent.

Fishing Vessel Insurance in Barbados, B.W.I.

DUDLEY W. WILES

Q. Suomela: Mr. Wiles, according to your paper, the fishing industry in Barbados is handicapped due to insurance rates. Could you give us any estimate of the magnitude of this, in terms

of layoffs of vessels? What has been done by your government to improve the situation?

A. Wiles: Actually there has been no layoff of the fishing fleet because of lack of insurance, because there is no compulsory insurance unless the particular boat owner has enjoyed a loan from the government sources for repairing or building such boats. The man covers his own losses if he doesn't have a policy. We are trying to encourage vessel insurance because every time a vessel owner is hurt financially by a loss he falls back harder on the government loan scheme. The result is more money being required to finance replacement and repairs of vessels. That is why we think very earnestly on this insurance problem. But we are conscious of the very high rate being charged, 12% - 15%. We are going to have to choose between commercial insurance companies or the device of floating insurance within our own government loan scheme. I have worked up loss figures very carefully over the last 10 years and if the government is going to be able to handle any mass emergency, such as might occur as the result of a hurricane, the government had better decide now to use some of that loan scheme money as the capital for the formation of an insurance plan. In this way everyone would have the opportunity of subscribing towards helping himself.

Q. Eddy: Do you think there is a serious weakness in the construction of fishing vessels in Barbados? Do they lack qualities that they could have if standards were set up by the government, and the government required fishermen to meet those standards prior to being insured? In my experience the fishermen are vitally concerned with the quality of their craft. Their operation depends upon their faith in the strength of their vessel. I wonder if the establishment of minimum construction specifications would relieve the situation that you have complained about?

A. Wiles: I feel that the low standards of our boats are the cause of the high insurance rates. We are launching a scheme of a gradual mechanization of the old fishing fleet; it will probably take us five or six years to get anywhere with it. The government began the scheme only 10 days before I left Barbados. I feel pleased to have been able to get them to accept it, and here again I must thank the Gulf and Caribbean Fisheries Institute. Having attended the last meeting where the mechanization of boats was discussed, I got the full backing of a meeting of this size with relation of the importance of gradual change-over to mechanization. Ordinarily the government might have been persuaded to undertake the scheme in another three to five years, but it has come in 10 months. Our Assembly granted $25,000 to assist in mechanization of about

six boats. We want to make the change gradually, over five years, taking five boats each year. The results are to be watched. I don't think they'll be watched longer than three years and then we will probably extend it to fifty boats a year, because fish does mean a great deal to our island. When it comes to standards we are insisting that the boats be large; the forward section would be decked and a small cabin would be built as protection for the engine and a section of the hull. The after section of the boat may be an open cockpit or it may also be decked. The insurance rate on such a boat, I think, will be considerably less than the present boats, since the chances of losses will be considerably reduced. Standards for boats are definitely coming and we are trying to establish a minimum standard which would be acceptable, not only on the government loan scheme to qualify the boats for loans for mechanization, but also to give a minimum standard which would qualify them for insurance.

A Fisherman and His Insurance: A Case History of Hull and P. & I. Claims

JOHN ROBAS

Q. Ringhaver: Did that experience with your engine have any effect on your premium the following year?

A. Robas: No.

Q. Ringhaver: What disposition was made of the engine?

A. Robas: I could do anything I chose with the engine. It was mine and had I been able to repair it and use it, I could have done so. However, it is almost impossible to seal an engine of that size so we sold it for junk.

Linehan (Comment): In Massachusetts, insurance policies being written now do not and cannot contain the Inch Maree clause. Policies in the south are still being written with the Inch Maræ clause included.

Q. Robas: Have there been any severe and numerous claims for engine damage?

A. Linehan: Yes.

Q. Robas: I am amazed that that situation prevails, but I presume that the underwriters went as far as they could go and then eliminated the clause.

Linehan (Comment): I want to support your statement that it is most important that Congress take the fishermen out of the provisions of the Jones Act and place them under seaman's compensation. Any action that is taken by any group in the United States to establish such a law, will get the wholehearted support of Massachusetts. I hope that if nothing else comes out of this conference, it will produce an American

council of commercial boat owners to try to work collectively toward that end.

Robas (Comment): I anticipate that any move made to remove fishermen from their present favorable position will meet with bitter opposition from the seaman's unions. It will take a number of years and a lot of hard work to put through such legislation. However, I think that we may be faced with that decision, or tie the boats up.

Q. Garcia: I want to congratulate Mr. Robas for his statement that he reads his policy every now and then. That should be a universal custom. Mr. Robas gave me the impression that the United States owners and fishermen can have the coverage of the workmen's compensation. Wouldn't the seaman be better off to be under the workmen's compensation law where there are fixed regulations on how to handle a claim before the claim was made? In other words, if a man gets hurt he has definite rights and a definite indemnification, fixed according to his salary. At present the indemnification as I gather from Mr. Robas may be any amount.

A. Robas: It would be desirable for a seaman to have workmen's compensation, where an injured seaman has definite rights and definite obligations laid out well in advance. With P. & I. insurance he must actually sue the owner. That brings us to the question of a seaman's compensation law that would be precisely suited to marine life. I think it would result in tremendous economies. Most of the seafaring nations of the world have such a law—Norway, Denmark, Holland to name just a few. I am told reliably that their protection and indemnity insurance, which covers many of the things that ours does, costs them roughly one quarter as much as an American pays for the same service. I think some time soon—not this year or next—we are going to find ourselves confronted with a necessity of going out of business or getting our fishermen under a seaman's compensation act modeled after that of some of those in European countries.

Garcia (Comment): The medical director in our company has been handling most of the injuries and sicknesses suffered by American seamen in Cuba, and I can tell you that those men get the best hospitals, with all kinds of luxuries. That is because the fees are not regulated as ours are so the cost of seaman's insurance is terrifically high.

Robas (Comment): I know of one case where a seaman was seriously injured on the Campeche banks. He was crushed between two boats trying to jump from one to another while they were transferring shrimp. They landed him at the nearest port in Mexico and they were fortunate enough to get him ashore alive. The port was a small town with very limited hospital facilities. In the meantime, the master of the

vessel called his owner and had relayed word. The owner in turn advised his underwriter. The P. & I. underwriters reached Mexico by radio and they ordered an airplane to fly the injured man to Miami. When the plane arrived in Miami there was an ambulance waiting at the airport with a doctor aboard, and they rushed him to the hospital and were successful in saving his life. That was taken up entirely upon the initiative of the P. & I. underwriters. I see no manner in which the service that was given that injured man could have possibly been improved on, because absolutely no expense was spared.

Q. Crawford: Do you carry both P. & I. and Workmen's Compensation? On my fleet of boats I have both and I'm wondering if we still need both.

A. Robas: I believe that you are needlessly spending money for Workmen's Compensation. If you have Workmen's Compensation and a man is injured, the Workmen's Compensation underwriters may very well settle with that man for, say $3,000. He can then take the $3,000 and sue you, under marine laws. If you have P. & I. insurance alone you pay only the first $50, if you hold a $50 deductible policy. If the seaman sued me for $75,000 for T.B. it cannot cost me more than $50.00. Thus, if you are carrying Workmen's Compensation and P. & I. insurance on the same vessel you are wasting money that you are paying on Workmen's Compensation.

THURSDAY—NOVEMBER 18

Chairman—LOUIS S. MOWBRAY, *Curator, Bermuda Government Aquarium, Flatts, Bermuda.*

A Comparison between Giant Bluefin Tuna *(Thunnus thynnus)* from the Straits of Florida and the Gulf of Maine, with Reference to Migration and Population Identity[1]

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Introduction

Ever since giant bluefin tuna *(Thunnus thynnus)* were discovered in the Straits of Florida, migrating northward during late spring along the edge of the Bahama Bank, speculations as to their destination after leaving the Bahamas have included various conjectures. Some have believed the fish followed the "Gulf Stream" all the way to Europe and others were of the opinion that they continue migrating towards the north, and are the same fish that arrive off the coasts of New England and Nova Scotia during the early summer. Few of these ideas, entertained mostly by anglers and fish guides, have ever been printed, and comments on the subject are mostly confined to the angling literature (Farrington, 1949; Mowbray, 1949). The possibility that the Bahama fish migrate to the north and may be the same as those occurring there later in the season has been recently suggested by Bigelow and Schroeder (1953) and by the writer (Rivas, 1954).

The destination of the bluefin tuna passing through the Straits of Florida constitutes an important element of their life history, both from the point of view of migration and population identity. If the Bahama fish are the same as those arriving in northern waters during early summer, two conclusions can then be formulated. First, that there is a seasonal migration from the south (Straits of Florida) to the north (Gulf of Maine). Second, that the Bahama fish form part of the population occurring in northern waters during the summer and fall. As a logical corollary, it could also be concluded that the fish return to the south after their sojourn in the north, to resume their yearly cycle. In addition, it is of interest to discover the reasons for such migrations and the manner in which they are effected.

The present study is a contribution towards the solution of the above problems. It represents the result of investigations conducted through a research fellowship made available to the University of Miami Marine Laboratory by the Charles F. Johnson Foundation, Inc. In addition to the Johnson

1 Contribution No. 145 from the Marine Laboratory, University of Miami. This constitutes a technical report to the Charles F. Johnson Foundation.

Foundation, the cooperation of the management of the Cat Cay Club, Bahamas and of the officers and anglers participating in the eighth, ninth and tenth Cat Cay International Tuna Tournaments (May 1952, 1953, 1954) is gratefully acknowledged. Thanks are also due to the Wedgeport Tuna Guides Association, Wedgeport, Nova Scotia, and the United States Coast Guard, Miami, Florida.

Material and methods

Morphometric and meristic comparisons are based on 26 fresh-caught specimens, 1997—2493 mm in fork length, captured by anglers in the vicinity of Cat Cay, Bahamas, in May 16—29, 1952—1954, and 9 fresh-caught specimens 2059—2534 mm. in fork length, captured by anglers in the vicinity of Wedgeport, Nova Scotia, on October 3, 1952 and August 7—10, 1953. Of the 26 Bahama specimens, only 19 were fully measured and only counts were made on the remaining seven. All of the nine Wedgeport specimens were fully measured. The original measurements are given in Tables 8 and 9.

The methods used for measuring and counting are essentially those proposed by Godsil and Byers (1944) and Marr and Schaefer (1949), with the exception of certain modifications and additions introduced by the writer. The measurements made are listed below. The name of the measurements as designated by Marr and Schaefer (1949) is indicated in parenthesis.

First predorsal length (snout to insertion first dorsal). Second predorsal length (snout to insertion second dorsal). Prepectoral length: from tip of snout to insertion of erect, pectoral fin. Prepelvic length (snout to insertion ventral). Preanal length (snout to insertion anal). Origin of first dorsal to origin (insertion) of pectoral (pectoral insertion to insertion first dorsal). Origin of pelvic to vent: from the insertion of the erect pelvic (usually the left) to the anterior margin of the vent. Snout length: from its tip to the anteriormost point on the fleshy margin of the orbit. Mandible length: from its tip to the end of mandibular slit. Width of caudal peduncle at keels (greatest width caudal peduncle at keels). Height of first dorsal fin: from the origin of the erect first dorsal fin to its highest point. Height of second dorsal fin (length second dorsal). Height of anal fin (length anal). Length of pectoral fin (length pectoral). Length of pelvic fin: measured like the pectoral. Length of upper or lower caudal lobe: from posterior end of caudal keel to tip of lobe. Other measurements are self-explanatory or identical in name and method with those proposed by Godsil and Byers (l.c.) and Marr and Schaefer (l.c.)

Proportions are expressed in thousandths of the fork length (tip of snout to tip of middle caudal ray) and measurements (in millimeters) were taken with slide calipers, according to the procedure described by Godsil and Byers and Marr and Schaefer. The lateral measurements were usually taken on the left side of the fish.

Occurrence of giant bluefin tuna in the Straits of Florida and in northern waters

The periodical occurrence of spawning bluefin tuna in the Straits of Florida has been recently described by the writer (Rivas, 1954). In that study it was established that the migrating fish move along the Bahama side of the Straits of Florida in a northerly direction and that the migration lasts from

about the middle of May to the middle of June. It was also established that only large adult individuals weighing not less than about 300 pounds are involved in this migration (Table 2). It is obvious therefore, that only fish of equivalent size in northern waters will be considered as presumably arriving from the Straits of Florida. Bluefin tuna of this large size are usually referred to as "giant tuna" and occur in northern waters during the summer and fall along with smaller individuals (Crane, 1936; Westman and Gilbert, 1941; Westman and Neville, 1942; Bigelow and Schroeder, 1953). The whereabouts of these smaller fish during the period from about November through June are still unknown.

The periodical occurrence of giant tuna in northern waters from late spring through early fall has been common knowledge for many years (Crane, 1936; Heilner, 1937; Westman and Neville, 1942; Farrington, 1949; Bigelow and Schroeder, 1953). The species was first recognized by the herring fishermen as a giant mackerel-like fish "as big as a horse" (thence the name, "horse mackerel"), and later scientifically described by Storer (1867) as *Thunnus secundo-dorsalis=T. thynnus,* from specimens obtained at Cape Ann and Provincetown. In northern waters giant tuna occur from off New Jersey to the Gulf of Saint Lawrence, but they are much more abundant in the Gulf of Maine from Cape Cod to Nova Scotia (Bigelow and Schroeder, 1953). As to season, a survey of the literature and of records kept by angling clubs and commercial fishermen indicates that the fish usually arrive in northern waters during June and early July. They remain in these waters through early fall, and appear to be absent throughout the winter and early spring. Crane (1936) has pointed out that the first bluefin tuna appear off Portland, Maine in the latter part of June, are common in July and August and become scarce in September. They vanish altogether early in October.

Giant tuna congregate in the north to feed (Crane, 1936; Bigelow and Schroeder, 1953; Rivas, 1954), and the main feeding grounds extend from the Cape Cod area northward throughout the Gulf of Maine. Crane (1936) states that the bluefin tuna season off Portland, Maine, corresponds exactly to that of the herring and mackerel.

Correlation of migratory rate and direction with time and distance traveled

The chronological sequence involving the time of occurrence of the migration through the Straits of Florida (late spring) and the time of arrival of the fish in northern waters (early summer), correlated with the direction of the migration in the Straits of Florida (north) would seem to indicate that the fish travel from one point to the other. To add support to this assumption, however, it would be necessary to establish that distance and time are in reasonable agreement with migratory rate (in terms of distance traveled per unit of time) and that the possible cause for such a migration is in accordance with its effect.

The average migratory speed of tuna while moving through the Straits of Florida has been estimated by the writer at about 3.5 knots, on the basis of observations conducted in Bahama waters from surface vessels and from low-flying planes, during the seasons of 1951, 1952 and 1953.

The procedure followed from surface vessels was to keep a school in sight from as far away as possible, and follow it for the longest possible distance. The ground speed was obtained by comparison with the known ground speed

of the vessel. It should be pointed out that tuna schools in Bahama waters can be approached to within a very short distance without disturbing the direction or speed of the fish, provided the approach is effected slowly and without sudden changes of the engine's speed. Usually a distance of not less than about 50 yards was maintained, with the vessel to the side or ahead of the school and never behind. Observations were conducted during different times of the day and under various weather and ocean conditions, in the area between Riding Rocks and Bimini.

Time of day did not seem to have any effect on the fish movements, but fairly strong southerly winds caused them to move faster, and strong northerly winds to move slower. This effect of wind direction and force on the tuna has been well-known to anglers and guides in Bahama waters for many years.

The numerous observations conducted according to the procedure discussed above indicate that the traveling speed of bluefin tuna in the Straits of Florida varies from about three to five knots, with an average of about four knots.

The procedure followed from airplanes was to locate a school and follow it for the longest possible distance between two points of reference. The speed was obtained by dividing the distance travelled by the time taken by the fish to travel from one point to the other. For example, on April 24, 1952, a school of four fish was sighted directly west of Orange Cay at 1409 and followed to a point five nautical miles directly north of the island, where the fish were lost at 1539. It took the school one hour and 30 minutes to travel a distance of five miles, and the speed attained was therefore 3.3 knots.

The results obtained from aerial and surface observations are in agreement, but it must be pointed out that these observations have also shown that any given school of tuna may stop traveling for short periods of time and remain "milling around" in a given area, presumably engaged in the act of spawning. These stops do not appear to occur frequently and usually do not last for periods of much more than about two hours. On May 23, 1951, a milling school of about 100 individuals was sighted from a Coast Guard plane in shallow water about five miles southwest of Great Isaac lighthouse. It took the school two hours and 15 minutes to resume travel in the usual northward direction. Of all the observations conducted on stationary schools, this has been the longest.

Taking all the above factors in consideration, it is reasonable to assume that although a speed of about four knots was observed when the fish were actually traveling, an average rate somewhat less than this would be obtained in their migration through the entire northern part of the Straits of Florida. The distance between Riding Rocks and Manzanilla Shoals (Figure 1) is 135 nautical miles, and if the fish were constantly traveling at a speed of four knots, it would have taken them 34 hours to cover that distance. If it is assumed that the school stops for at least one period of about two hours during that time, the average speed for that distance would then be of 3.5 knots, corresponding to an average migratory rate of 84 nautical miles per day.

Obviously, the migratory speed of bluefin tuna is not known for the area between the Straits of Florida and northern waters, which these fish are assumed to traverse. If, as assumed, spawning is completed when the fish leave the Straits of Florida (Rivas, 1954), there is no reason to believe that they may stop again for that purpose on their way north. There is also no reason to believe that the hunger drive may increase migratory speed. It has been

recently shown (Rivas, 1954) that giant tuna feed little or not at all during their occurrence in the Straits of Florida. It would seem, therefore, that the fish, after a period of fasting and exhaustion resulting from spawning, would be eager to proceed to the feeding grounds in the north. The traveling speeds observed in the Straits of Florida, however, appear to be the same for schools assumed to be composed of spent fish (Rivas, 1954) and those assumed to be composed of ripe fish. In addition, it is reasonable to assume that the weakened condition of the fish would not be compatible with the expenditure of energy that would be required for sustained increased volocity in traveling the long distance (more than 1000 miles) to the north.

In order to correlate migratory rate with time and distance traveled, it is necessary to establish the time of arrival of the fish at a given point in the Florida Straits and in the north, and to establish the distance between these points. The choice of these points depends, of course, on the availability and reliability of records, and according to this criterion the most suitable points appear to be Cat Cay, on the Bahama side of the Straits of Florida and the Cape Cod area. In addition, the Cape Cod area represents, as already indicated, the beginning of the feeding grounds of the tuna. It would seem, therefore, that the fish do not stop or reduce their speed for feeding purposes before reaching the Cape Cod area. The distance between Cat Cay and Cape Cod is 1,150 nautical miles.

The time of arrival of giant tuna in the waters adjacent to Cat Cay has been recently discussed in detail by the writer (Rivas, 1954). In that study it was established, on the basis of surface and aerial observations, that although a few individuals arrive during late April, the bulk of the migration does not arrive in the area until about the middle of May. Examination of the records kept by Mr. John Mahony for Cat Key Club shows that the run began about May 18 in 1951, about May 12 in 1952, and about May 17 in 1953.

Dates of the first trap net catches of giant tuna in the Cape Cod area from 1947 through 1954 have been obtained by Frank J. Mather of the Woods Hole Oceanographic Institution and Howard Schuck, formerly of the U. S. Fish and Wildlife Service. These records have been made available to the writer *(in litt.)* and show that the earliest catches have occurred between May 25 (1953) and June 21 (1947). In six out of the eight years recorded, the earliest catches have occurred between May 30 and June 11, which would seem to indicate that the bulk of the migration arrives in the Cape Cod area usually during the first week of June.

If the distance between Cat Cay and Cape Cod is 1,150 miles, and the estimated migratory rate of the tuna is 84 miles per day, it would take the fish about 14 days to travel that distance. This is in agreement with the time of arrival of the fish in the Cat Cay area (middle of May) and later in the Cape Cod area (early June).

As to the direction of the migration when the tuna leave the Straits of Florida, it would seem that if the fish continued to travel in a northerly direction, they would strike the American coast in the vicinity of Charleston, South Carolina (Figure 1). However, at about 120 miles south of Charleston, the Florida Current turns towards the northeast. Since the fish are traveling with the current, it is to be expected that the change of direction of the current would also deflect their direction towards the northeast.

No giant bluefin tuna have ever been captured or seen between the Straits

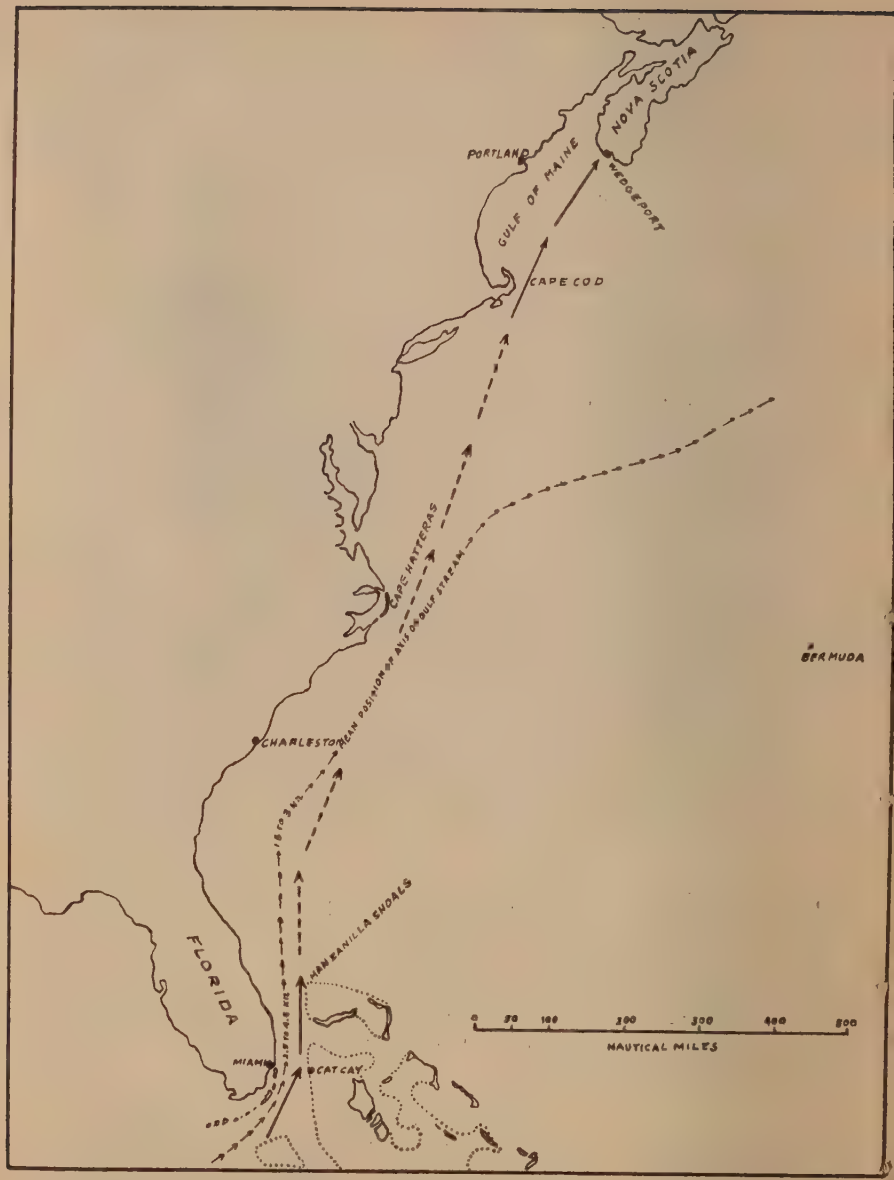

FIGURE 1.—East coast of North America from the Straits of Florida to Nova Scotia, showing the presumed migratory route (arrows) of giant tuna *(Thunnus thynnus)*. Data on Gulf Stream from U. S. Navy Hydrographic chart No. 1411.

of Florida and northern waters, but this may be attributed to lack of exploration rather than to their absence there. Examination of a chart (Figure 1) would show that their assumed route would bring them relatively close to Cape Hatteras, at a distance of probably 30 to 150 miles east of the cape. It is possible that giant tuna have never been seen there because they may be traveling deep, as they and related species appear to do when occurring in deep water (Rivas, 1953).

As to the possible reasons for a northward migration immediately following spawning, it is obvious that its logical cause is in accordance with its effect. As already indicated, giant tuna appear to cease feeding during their spawning period in the Straits of Florida and it has been established in the present study that the feeding grounds are located in the north and that the fish are engaged in that activity during their occurrence in that area. In addition to the data already published on feeding habits (Crane, 1936; Bigelow and Schroeder, 1953; Rivas, 1954) and based almost entirely on stomach contents and size of the stomach, the chronological sequence of body condition is also in agreement with the time, cause and effect of the assumed migration, as discussed in the next section.

Correlation of body condition with time and place of occurrence

The giant tuna captured in the Straits of Florida are leaner in appearance and weigh less on the average than the fish from the northern feeding grounds (Tables 1 and 2). These conditions have been known for many years to anglers fishing both the Bahamas and northern waters, and appear to be correlated with decrease or cessation of feeding during spawning (Rivas, 1954) followed by intense feeding. Mowbray (1949) has already pointed out that the lean condition of bluefin tuna in the Bahamas might be due to spawning, and Bigelow and Schroeder (1953) state that " . . . they are much thinner in the spring in their more southern habitat than they are in summer to the northward."

If the giant tuna passing through the Straits of Florida are the same as those occurring later in the north, then the northern fish should be leaner upon arrival during the early part of the season and heavier towards the end. This change of body condition has been observed by anglers and commercial fishermen for years, and Crane (1936) states that when bluefin tuna appear off Portland, Maine, in the early summer (late June, early July), they are "always much thinner than later on." Table 1 shows the increase in weight of giant tuna from Wedgeport, Nova Scotia, for every season during the years 1947-1952. The weight records on which Table 1 is based were furnished by Mr. Elson Boudreau of the Wedgeport Tuna Guides Association. Every fish taken in the area from the smallest "school tuna" to the largest giant tuna is listed, with the date, weight and name of the angler throughout the season.

Although the Wedgeport fish are leaner during the early part of the season (July) than later on, they are already about 7.5 percent heavier than the Bahama fish, as shown in Table 2. This may be explained by their sojourn in the feeding grounds for a period of about a month, while moving from the Cape Cod area to Wedgeport. As already discussed, the tuna arrive in the Cape Cod area, presumably from the Bahamas, during early June, and according to the Wedgeport records they arrive in the latter area during early

TABLE 1.—Weight frequency distribution (pounds) of 1060 giant tuna *(Thunnus thynnus)* from Wedgeport, Nova Scotia, for July and September, 1947-1952, showing increase in weight during the season. The smallest fish weighed 298 pounds, the largest 932. Data from records kept for the Wedgeport Tuna Guides Association and furnished by Mr. Elson Boudreau.

Year	Mean Weight	250-299	300-349	350-399	400-449	450-499	500-549	550-599	600-649	650-699	700-749	750-799	800-849	850-899	900-949
							JULY								
1947	522			1	5	4	9	4	3	1	1				
1948	501	1	2	5	11	14	20	13	6	4	1				
1949	499			5	8	12	12	14	3	1					
1950	517		1	5	6	10	11	3	9	5					
1951	503		5	8	8	14	23	10	5	6	2				
1952	492		1	7	7	8	18	4	3	2					
Totals	506	1	9	31	45	62	93	38	29	19	4				
							SEPTEMBER								
1947	611			3	6	7	20	49	46	36	21	5	2	3	
1948	578			10	8	5	20	30	38	26	8	1		1	
1949	535			11	29	21	27	20	26	14	6	4		2	
1950	560			6	4	8	14	12	13	12	2				
1951	611			2	2	10	11	13	15	15	8	4	2		1
1952	579			3	3	10	12	12	13	7	6	3	1		
Totals	579			35	52	61	104	136	151	110	51	17	5	6	1

TABLE 2.—Weight frequency distribution (pounds) of 381 giant tuna *(Thunnus thynnus)* from Cat Cay, Bahamas (May and early June, 1947-1942), and 331 from Wedgeport, Nova Scotia (July, 1947-1952). The smallest Bahama fish weighed 292 pounds, the largest 719. The smallest Wedgeport fish weighed 298 pounds, the largest 741. Bahama data from records kept for Cat Key Club and furnished by Mr. John Mahony. Nova Scotia data from records kept for the Wedgeport Tuna Guides Association and furnished by Mr. Elson Boudreau.

Year	Mean Weight	250-299	300-349	350-399	400-449	450-499	500-549	550-599	600-649	650-699	700-749
					BAHAMAS						
1947	466		2	5	15	15	8	4	3	1	
1948	482		2	9	20	19	13	10	6	1	1
1949	482	1		3	8	12	10	3	4		
1950	479		2	6	18	17	14	5	4		
1951	456		1	5	7	10	3	2	1		
1952	440	2	5	20	41	25	9	8	1		
Totals	467	3	12	48	109	98	57	32	19	2	1
					NOVA SCOTIA						
1947	522			1	5	4	9	4	3	1	1
1948	501	1	2	5	11	14	20	13	6	4	1
1949	499			5	8	12	12	14	3	1	
1950	517		1	5	6	10	11	3	9	5	
1951	503		5	8	8	14	23	10	5	6	2
1952	492		1	7	7	8	18	4	3	2	
Totals	506	1	9	31	45	62	93	38	29	19	4

July. This increase in weight of about 7.5 percent per month is further confirmed by a similar increase observed in Wedgeport between July and September, as shown in Table 1.

According to the Bahama weight records, only three fish out of 381 weighed during the period 1947-1952, weighed less than 300 pounds, and the smallest weighed 292 pounds (Table 2). If the Bahama run includes only giant tuna of not less than about 300 pounds and if these fish increase their weight through feeding by about 7.5 percent per month, it is obvious that Wedgeport fish weighing not less than about 370 pounds in September should be considered as having come from the Straits of Florida.

In addition to mean weights, the observed lean and robust condition of Bahama and Wedgeport individuals respectively, can be expressed by length-weight relationships and by certain morphometric characters that reflect leanness or robustness of the body, as shown in Table 3. The samples compared in Table 3 are of similar length and therefore directly comparable. The lean

TABLE 3.—Comparison of giant tuna *(Thunnus thynnus)* of similar length, from Cat Cay, Bahamas, and Wedgeport, Nova Scotia, on the basis of morphometric characters reflecting leanness or robustness of the body. Proportions are expressed in thousandths of the fork lenth.

	BAHAMAS		NOVA SCOTIA	
	Range	Mean	Range	Mean
Number of individuals	19		9	
Time of year	May 16-28		Aug. 7-Oct. 3	
Length in millimeters	1997-2493	2269	2059-2534	2286
Weight in pounds	297-593	433	376-701	522
Girth	630-752[1]	689	716-765	733
Origin first dorsal to origin pectoral	138-163	150	152-166	159
Origin first dorsal to origin pelvic	233-267	247	248-268	257
Greatest depth of body	242-282	257	256-284	269
Origin second dorsal to origin anal	204-227	217	226-242	234
Depth of body at 6th finlet[2]	93-111[3]	102	105-119	113
Least depth of caudal peduncle	24-30	27	25-28	27
Width of body at origin of pectoral	169-196[4]	183	181-198	190
Greatest width of body	172-200[5]	185	188-209	199
Width of body at origin of anal	108-142[6]	126	132-167	148
Width of body at 6th finlet[2]	75-88[3]	81	80-106	91
Width of caudal peduncle at keels	73-81[7]	76	74-86[8]	81

[1]Only 17 specimens measured (see Table 8)
[2]Counting from last finlet
[3]Only 8 specimens measured (see Table 8)
[4]Only 15 specimens measured (see Table 8)
[5]Only 18 specimens measured (see Table 8)
[6]Only 17 specimens measured (see Table 8)
[7]Only 13 specimens measured (see Table 8)
[8]Only 7 specimens measured (see Table 9)

condition of the Bahama fish as compared with the northern fish is more apparent to visual inspection in the anterior region of the caudal peduncle. This is shown in Table 3 by the progressively increasing difference in depth and width from the region of greatest cross-section of the body (behind pelvic fins) towards the second dorsal and anal fins. The difference between the means of greatest depth of body, greatest width of body, origin of second dorsal to origin of anal and width of body at origin of anal, correspond to 12, 14, 17 and 22 respectively and represents 5, 8 and 17 percent of the mean of the shorter character. The characters relating to depth and width of caudal peduncle are identical, or nearly so. This is to be expected, since the muscle and adipose tissue surrounding the vertebral column becomes very thin at the narrowest part of the caudal peduncle.

Morphometric and Meristic Comparisons

The two different approaches discussed in the preceding sections are mutually confirmative and indicate that the Bahama giant tuna migrate to the north in the late spring. It would seem, therefore, that the Bahama and the Gulf of Maine fish are the same, or that at least they form part of the same population, and that biometric comparison would show that they are identical. It is reasonable to assume that if a large number of significant, reliable characters is used without detecting differences, the samples may be considered to be identical.

Godsil (1948), on the basis of five characters, concluded that the yellowfin tuna *(Neothunnus macropterus)* ranging from Lower California to the Equator, form part of a single, intermingling population. This conclusion was arrived at despite the fact that statistical analysis showed significant differences between the 13 samples used, but he attributed these anomalous conditions to fundamental differences in the concepts of statistical and biological homogeneity. He concluded that the differences observed were phenotypic rather than geographical, since differences were observed even between samples collected in the same locality. Most of the specimens used by Godsil were young, less than a meter in length, collected over a period of four years (1936-1940), and as he points out, "Varying environmental conditions during the developmental period undoubtedly result in slight variations in the characteristics of individuals." These conditions would not produce statistical homogeneity despite the fact that the samples come from a population assumed to be biologically homogeneous and composed of freely intermingling individuals. As a corollary to the above discussion, it may be assumed that if the samples really represent a single, homogeneous population, statistical homogeneity will be dependent on the age (size) of the individuals composing the sample. In other words, the older and larger the individuals, the higher the probability of attaining statistical homogeneity.

In the present study the problem is greatly simplified, since the samples compared are composed of large, adult individuals of similar size, already assumed to form part of the same population on the basis of the evidence discussed in the preceding sections.

The morphometric comparison between giant bluefin tuna from the Bahamas and Nova Scotia is given in Table 4 on the basis of 19 characters, including those customarily employed by racial workers. As already indicated, the samples are composed of individuals of similar length and therefore di-

TABLE 4.—Morphometric comparison between giant tuna *(Thunnus thynnus)* of similar size, from Cat Cay, Bahamas, and Wedgeport, Nova Scotia. Proportions are expressed in thousandths of the fork length.

	BAHAMAS		NOVA SCOTIA	
	Range	Mean	Range	Mean
Number of individuals	19		9	
Time of year	May 16-28		Aug. 7-Oct. 3	
Length in millimeters	1997-2493	2269	2059-2534	2286
First predosal length	273-292	282	276-291	283
Second predorsal length	509-537	522	514-534	521
Prepectoral length	274-296	281	272-282	276
Prepelvic length	296-326	311	296-321	310
Preanal length	581-618	600	582-608	595
Origin of pelvic to vent	280-305[1]	295	280-309	298
Head length	265-286	272	267-280	273
Snout length	95-102	98	97-102	99
Orbit diameter	24-30[2]	26	24-30	26
Maxillary length	97-105	101	100-106	103
Mandible length	102-114[3]	107	105-113[4]	108
Interorbital width	103-116[5]	108	108-118	112
Height of first dorsal fin	86-124	111	102-120	108
Height of second dorsal fin	142-190	158	147-173	156
Height of anal fin	140-170	152	137-153	148
Length of pectoral fin	173-203[6]	188	184-194	188
Length of pelvic fin	110-120[7]	115	108-125	113
Length of upper caudal lobe	191-216	204	197-216	207
Length of lower caudal lobe	193-216	206	197-218	209

[1]Only 10 specimens measured (see Table 8)
[2]Only 18 specimens measured (see Table 8)
[3]Only 12 specimens measured (see Table 8)
[4]Only 8 specimens measured (see Table 9)
[5]Only 18 specimens measured (see Table 8)
[6]Only 17 specimens measured (see Table 8)
[7]Only 18 specimens measured (see Table 8)

rectly comparable. Examination of the means show that their difference in all characters is five or less and that no statistical computations are needed to show that the two samples are identical on the basis of all characters. Attention is called to the fact that the shorter the characters, the smaller the difference between their means, and in characters resulting in about 100 thousandths of the length or less, the difference between the means is always 0, 1, or 2. In all characters, the difference between the means represents less than four percent of the mean of the shorter character, and in most characters the difference represents less than two percent. In all characters the range of variation of one sample either coincides with the range of the other or is included in it. For obvious reasons discussed in the preceding section, morphometric characters correlated with leanness or robustness of the body (Table 3) have not been included in Table 4.

It is interesting to note that characters such as head length, first and second predorsal lengths, prepelvic and preanal lengths, length of pectoral fin and heights of first dorsal, second dorsal and anal fins, in which populations of other species of tunas have usually been found to differ (Godsil, 1948; Schaefer and Walford, 1950; Godsil and Greenhood, 1951,) are identical in the samples compared in the present study. In addition, these racial studies show that the larger (older) the fish compared, the greater the difference between most of these characters.

Meristic comparisons are given in Tables 5 to 7 in which six characters are considered. The difference between the means was tested for each character and no significant difference was found to occur. In all cases the standard error of the difference was found to be less than 0.5.

The evidence presented above indicates that it is highly probable that the samples compared in the present study were drawn from the same population. This is in accordance with the indications discussed in the two preceding sections.

Conclusions

The evidence presented in this study strongly indicates, but does not prove conclusively, that the giant bluefin tuna occurring in the Straits of Florida in the late spring migrate to the north and constitute part of the same population occurring there during the summer and early fall. Definite proof will depend, of course, on tagging information, and until one or more fish tagged in the Straits of Florida are recovered in the north, the conclusions suggested by the present study must remain tentative. Farrington (1949) states that giant tuna ". . . have been caught at Wedgeport with Bimini (Bahamas) hooks in them" but he offers no proof to support his statement. The brands and sizes of hook used in Wedgeport are the same as those used in the Bahamas, and unless marked it would be difficult to identify a hook recovered in Wedgeport as having come from the Bahamas. Marked hooks were tried in the Bahamas (Bimini and Cat Cay) by Frank Mather and the writer in 1952 and 1953, and a dart-tag was used by Mather in 1954. So far no recoveries have been obtained from these efforts. A more extensive tagging program is planned for future seasons.

The three lines of approach discussed are in accordance and mutually confirmative. If the degree of morphological dissimilarity is an index of the degree of spacial separation between two populations, then the Bahama and

TABLE 5.—Frequency distribution of dorsal spines, rays and finlets in giant tuna *(Thunnus thynnus)* from Cat Cay, Bahamas, and Wedgeport, Nova Scotia.

	Spines		Mean	Rays			Mean	Finlets			Mean	Rays plus finlets				Mean
	13	14		13	14	15		8	9	10		21	22	23	24	
BAHAMAS	11	15	13.6	5	19	2	13.9	2	22	2	9.0	1	3	20	2	22.9
NOVA SCOTIA	5	4	13.4	2	5	2	14.0	1	6	2	9.1			8	1	23.1

TABLE 6.—Frequency distribution of anal rays and finlets in giant tuna *(Thunnus thynnus)* from Cat Cay, Bahamas, and Wedgeport, Nova Scotia.

	Rays			Mean	Finlets		Mean	Rays plus finlets			Mean
	13	14	15		8	9		21	22	23	
BAHAMAS	7	17	2	13.8	23	3	8.1	4	20	2	21.9
NOVA SCOTIA	1	7	1	14.0	6	3	8.3		6	3	22.3

TABLE 7.—Frequency distribution of gill rakers in giant tuna *(Thunnus thynnus)* from Cat Cay, Bahamas, and Wedgeport, Nova Scotia.

	Lower limb					Mean	Upper limb						Mean	Lower limb plus upper limb									Mean
	24	25	26	27	28		10	11	12	13	14	15		35	36	37	38	39	40	41	42	43	
BAHAMAS		7	11	5	3	26.2	1	2	9	11	2	1	12.5	1	1	4	3	11	4	1		1	38.7
NOVA SCOTIA	1	2	4	2		25.8			1	5	3		13.2			2	1	2	3	1			39.0

TABLE 8.—Original measurements (millimeters) of 19 fresh-caught speciments of giant tuna *(Thunnus thynnus)* from Cat Cay, Bahamas, May 16-29, 1952-1954.

Length	1997	2043	2112	2130	2150	2178	2190	2245	2260	2265	2274	2298	2302	2377	2420	2421	2470	2485	2493
Weight (pounds)	341	316	297	346	362	353	389	420	401	378	437	407	416	525	593	540	569	556	592
Girth	1500	1400	1328	1430	1520	1430	—	1600	1540	1470	1530	1500	—	1680	1740	1700	1730	1760	1770
First predorsal length	584	560	603	617	600	609	598	626	645	631	655	649	628	668	695	696	685	698	711
Second predorsal length	1073	1070	1096	1128	1098	1133	1113	1172	1182	1171	1190	1196	1204	1249	1263	1268	1263	1306	1293
Prepectoral length	590	574	585	628	604	598	603	627	640	638	631	635	653	685	665	682	692	696	696
Prepelvic length	646	647	624	696	677	668	684	691	683	694	715	685	729	754	756	775	778	763	765
Preanal length	1212	1223	1256	1307	1255	1302	1299	1344	1362	1325	1387	1333	1383	1425	1448	1465	1526	1507	1490
Origin 1st D. to orig. pect.	325	304	311	317	325	300	334	338	337	323	323	337	337	373	374	373	378	364	380
Origin 1st D. to orig. pelv.	533	496	492	515	538	516	542	561	548	530	551	545	560	615	623	628	610	610	638
Origin 2nd D. to orig. anal	451	443	433	455	463	458	494	503	484	471	506	470	479	517	550	534	548	544	548
Origin of pelvic to vent	609	600	—	—	603	—	653	650	661	—	—	660	689	708	732	—	—	—	—
Greatest depth of body	565	517	512	547	550	547	572	605	576	542	577	560	573	633	639	637	642	633	671
Greatest width of body	395	380	363	400	392	387	408	420	425	390	420	403	407	452	484	457	485	464	—
Width body at orig. pect.	393	374	358	393	385	383	—	415	415	389	406	—	—	453	462	457	473	455	—
Width body at orig. anal	264	275	227	253	275	245	288	297	257	260	—	280	282	297	345	337	344	308	—
Depth body at 6th finlet[1]	220	195	—	—	224	—	222	—	—	—	—	214	221	248	269	—	—	—	—
Width body at 6th finlet[1]	167	162	—	—	180	—	171	—	—	—	—	172	179	195	214	—	—	—	—
Least depth caudal peduncle	52	53	56	57	60	61	57	61	57	60	63	57	55	64	63	67	75	70	63
Width caud. ped. at keels	—	—	158	157	—	162	175	169	166	178	165	—	170	180	—	195	197	182	—
Head length	571	554	561	602	582	583	594	596	607	605	613	622	628	660	671	664	679	669	682
Snout length	203	195	201	214	213	213	210	220	220	219	224	222	225	239	247	241	240	248	250
Orbit diameter	61	55	58	58	57	56	55	61	60	60	60	60	—	65	58	65	69	63	60
Maxillary length	211	202	207	220	219	221	214	226	233	228	230	231	226	249	246	244	254	257	243
Mandible length	228	220	—	—	233	—	236	235	234	250	—	242	242	260	261	—	—	—	255
Interorbital width	226	217	218	230	232	229	232	244	242	237	247	250	247	277	270	263	268	268	—
Height of 1st dorsal fin	249	237	180	250	251	276	227	251	254	237	272	272	262	234	240	240	296	282	267
Height of 2nd dorsa lfin	288	311	306	335	336	332	335	404	357	363	328	400	328	364	358	460	404	383	450
Height of anal fin	282	286	305	325	334	320	352	367	385	370	326	327	326	354	345	397	395	367	422
Length of pectoral fin	—	404	415	424	420	428	420	456	415	429	404	398	—	421	435	452	455	462	460
Length of pelvic fin	225	243	233	247	247	244	259	271	—	255	250	272	259	276	281	282	292	276	281
Length upper caudal lobe	409	431	402	452	465	442	425	458	465	454	440	470	463	506	470	515	530	490	531
Length lower caudal lobe	413	419	413	448	447	452	427	458	465	466	455	480	468	510	466	520	533	511	537
Sex	M	F	F	F	F	F	M	M	F	F	F	F	F	M	M	M	M	F	F

[1]Counting from last finlet

TABLE 9.—Original measurements (millimeters) of 9 fresh-caught specimens of giant tuna *(Thunnus thynnus)* from Wedgeport, Nova Scotia, October 3, 1952 and August 7-10, 1953.

Length	2059	2113	2138	2197	2293	2393	2397	2450	2534
Weight (pounds)	380	385	376	467	504	573	640	701	675
Girth	1506	1510	1520	1650	1660	1720	1830	1870	1830
First predorsal length	586	607	614	639	660	661	667	689	717
Second predorsal length	1077	1092	1108	1171	1209	1230	1252	1275	1302
Prepectoral length	573	592	'582	597	638	651	675	689	691
Prepelvic length	643	671	653	683	702	709	763	787	765
Preanal length	1226	1229	1256	1333	1369	1395	1457	1472	1483
Origin 1st D. to orig. pect.	333	334	326	353	360	373	399	406	402
Origin 1st D. to orig. pelv.	522	538	530	572	589	594	641	657	653
Origin 2nd D. to orig. anal	479	480	484	524	543	557	578	592	587
Origin of pelvic to vent	611	592	620	674	696	716	742	738	756
Greatest depth of body	546	565	557	608	614	612	667	695	688
Greatest width of body	409	397	405	448	455	475	501	511	497
Width body at orig. pect.	389	388	388	424	440	451	476	490	483
Width body at orig. anal	297	280	295	347	329	358	365	410	372
Depth body at 6th finlet[1]	219	222	231	254	258	276	282	288	302
Width body at 6th finlet[1]	170	170	179	213	211	223	219	259	235
Least depth caudal peduncle	56	58	54	58	62	61	64	68	69
Width caud. ped. at keels	—	175	158	179	188	—	194	210	202
Head length	567	589	573	597	620	645	656	688	676
Snout length	211	217	209	218	223	235	238	242	250
Orbit diameter	61	58	57	56	59	60	64	65	60
Maxillary length	214	216	215	227	233	244	249	256	263
Mandible length	228	229	227	—	246	251	255	277	272
Interorbital width	243	240	242	240	249	259	270	284	281
Height of 1st dorsal fin	248	224	223	234	260	253	260	254	284
Height of 2nd dorsal fin	303	330	360	330	337	381	367	380	437
Height of anal fin	314	290	327	318	345	357	365	374	353
Length of pectoral fin	400	400	409	411	430	443	442	475	472
Length of pelvic fin	223	230	236	249	276	266	299	283	278
Length upper caudal lobe	429	447	436	434	471	498	487	522	546
Length lower caudal lobe	429	452	433	434	466	498	504	533	549
Sex	M	M	M	—	M	M	M	M	—

[1]Counting from last finlet

Nova Scotia samples cannot be assumed to represent separate units. Therefore, since these samples come from widely separated localities and the fish are absent in one place when present in the other, it must be also assumed that a migratory movement takes place between the two areas.

According to Heldt (1930, 1931) all the European giant bluefin tuna seem to constitute a single race or population, and to migrate to the northward after spawning. These conclusions were also tentative and based on a study of the recovery of hooks whose origin appeared to be well established. A Spanish hook recovered off Oslo, Norway, indicated that the fish had traveled more than 1000 nautical miles in less than a month.

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Comparación del Atún de Aleta Azul *(Thunnus thynnus)* de los Estrechos de la Florida y el Golfo de Maine, con Referencia a la Migración é Identidad de la Población

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Abstracto

Se presenta evidencia, indicando que los atunes gigantes de aleta azul que ocurren in los estrechos de la Florida durante mayo y junio, migran al Norte y forman parte de la población que se encuentra en New England y Nova Scotia a través del verano y principios del otoño. Dicha evidencia incluye comparaciones morfométricas, dirección y velocidad de la migración y condiciones del cuerpo.

Growth of Sub-Population of Mullet *(Mugil cephalus)* On the West Coast of Florida* (Abstract)

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Extensive market samples taken in 1950, 1951, 1952 and 1953 leave no doubt that mullet landed in the commercial fishery on the west coast of Florida became progressively smaller toward the north and west sections of the state. Subsequent studies of the juvenile mullet, market samples from the commercial fishery, tag returns, and scale analysis revealed the following information about the growth of the fish in west Florida.

1. The young mullet reach a mean size of 110 mm. at Pensacola, 115 mm. at Apalachicola, and 148 mm. at Cedar Keys during September of their first year of life. Peak spawning is during October, November and December.

2. The period of maximum growth of tagged fish was during May, June, July and August. There were indications that the tagging had a detrimental effect on the growth of the fish.

3. Scales proved to be successful in obtaining the age and growth of the fish. Fin ray sections, opercular bones, and vertebrae proved inferior, although they did display annual marks.

4. Scale analysis indicated that mullet from Pensacola and Apalachicola grew considerably slower than the fish from Cedar Keys and Homosassa.

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Crecimiento de Una Sub-población de Lisa *(Mugil cephalus)* en la Costa Occidental de la Florida

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Abstracto

Muestras comerciales extensivas tomadas en 1950, 1951, 1952 y 1953 no dejan lugar a duda de que lisas desembarcadas en la costa Occidental de la Florida se convirtieron progresivamente más pequeñas hacia el Norte y el Oeste del estado. Estudios subsecuentes sobre las lisas juveniles, muestras comerciales, marcas regresadas y análisis de las escamas revelaron le siguiente información acerca del crecimiento de este pez en la costa Occidental de la Florida.

1. La lisa joven llega a un tamaño promedio de 110 mm en Pensacola, 115 mm on Apalachicola, y 148 mm en Cedar Key durante septiembre del primer año de vida. El desove toma lugar durante octubre, noviembre y diciembre.

2. El período de máximo crecimiento de los peces marcados fué durante mayo, junio, julio y agosto. Hubieron indicaciones de que las marcas tuvieron un efecto perjudicial en el crecimiento de los peces.

3. Las escamas tuvieron éxito en obtener la edad y crecimiento de los peces. Sessiones de los radios de las aletas, huesos operculares y vértebras fueron de menos uso, aunque también exhibían marcas anuales.

4. Análisis de las escamas indicó que lisas de Pensacola y Apalachicola crecieron considerablemente más despacio que los mismos peces de Cedar Key y Homosassa.

Seasonal Movements and Growth of the Atlantic Croaker *(Micropogon undulatus)* Along the East Louisiana Coast[1]

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The material reported in this paper concerning the biology of the Atlantic croaker was only a part of that gained from an intensive biological study of Lake Pontchartrain. The full-scale sampling program was started in July, 1953 and has continued to date. The croaker and the southern bay anchovy *(Anchoa mitchilli diaphana)* were the two most abundant species in the estuarine areas sampled in this study. Croakers appeared in 83 per cent of the trawl catches and 76 per cent of the seine catches during a one year period of sampling in Lake Pontchartrain.

[1] Most of the material was obtained during a Biological Study of Lake Pontchartrain, a cooperative investigation by the Zoology Department, Tulane Universtiy, and the Commercial Seafoods Division, Louisiana Wildlife and Fisheries Commission.

Materials and Methods

Table I is based upon 25,081 specimens taken from Lake Pontchartrain during July, 1953 to October, 1954. These fish were obtained by trawling and seining. A sock of ¼ inch bar mesh was used over the tail of various sized trawls in order to catch large quantities of small young. Monthly collections were made at fifteen selected localities (Fig. 1). Of these fifteen, ten were designated as trawl stations and five as seine stations. Beside the regular monthly station collections, many supplementary collections were made in various parts of the lake. The data on several thousand croakers captured from the Louisiana marshes and from the Gulf of Mexico were used in the interpretation of growth and seasonal movements, although not included in Table 1 or Figures 2 and 3.. Some of the samples from the Gulf of Mexico were furnished by Mr. Stewart Springer, Chief of Gulf Fisheries Exploration and Gear Research for the United States Fish and Wildlife Service, whom the author wishes to thank.

The fish were measured and scale samples removed in the field whenever possible; otherwise, the process was completed upon return to the laboratory. Both total and standard length measurements were taken for a period of a year, after which standard length measurements were discontinued except when scale samples were removed. All total length measurements were made from the anterior tip of the snout to the tip of the center lobe of the caudal fin. This lobe is greatly produced in the young and is the most posterior element. In the large adults the upper tip of the caudal fin is usually longer than the center lobe but was not considered in the measurements. Impressions of selected scales from each sample were made in cellulose acetate with a screw-type press. This apparatus necessitated using acetone to soften the plastic strips before the pressure was applied. A microprojector was used to facilitate viewing of impressions.

Seasonal Movements

In 1953 the croakers migrated from Lake Pontchartrain during September, October and November. By the end of November only the smallest of the young-of-the-year group remained in the lake. The drop in water temperature was directly correlated with this movement of fishes out of the lake and was possibly the controlling factor. The length-frequencies in Table 1 indicated that the larger individuals of the remaining young-of-the-year group continually straggled out of the lake during November, December, and January. Thus the samples taken during those four months showed a decrease in average length (Figure 2). This, however, was evidently only a reflection of the decreasingly smaller individuals to be sampled, because of the smaller and smaller individuals leaving as the winter progressed. Apparently the migration from the lake stopped during February, or if it continued it was equalled by recruitment, because February and March samples showed progressive increases in length over January samples.

The first young of the 1953-1954 spawning were taken from Lake Pontchartrain in November, 1953. Because the fine meshed trawls and the sock adaptation were not employed until after November, the few young captured during that month probably did not indicate their true abundance. No young less than 10 millimeters in total length were taken at any time during the course of the investigation. The catches in December, January and February contained specimens which measured between 10 and 20 millimeters. Since

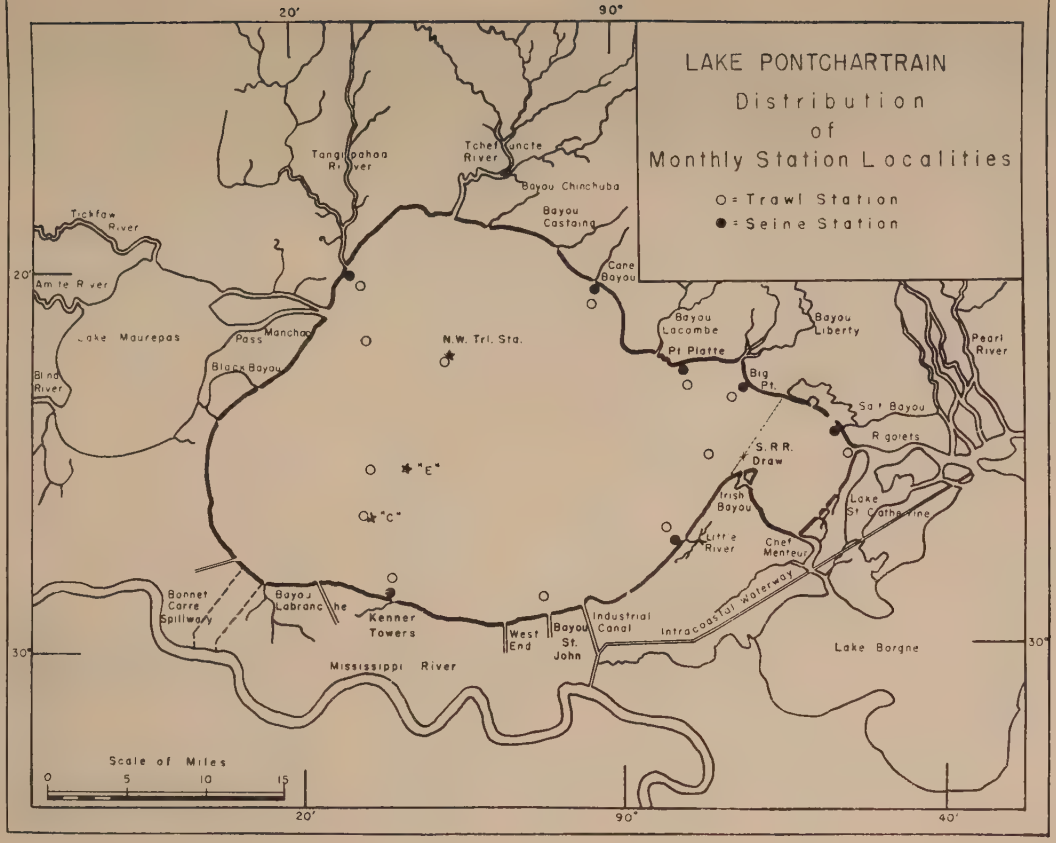
LAKE PONTCHARTRAIN
Distribution
of
Monthly Station Localities
○ = Trawl Station
● = Seine Station
20'
90°
Tangipahoa River
Tchefuncte River
Bayou Chinchuba
Bayou Castaing
Tickfaw River
Amite River
Lake Maurepas
Pass Manchac
Blind River
Blacks Bayou
Cane Bayou
Bayou Lacombe
Pt Platte
Bayou Liberty
Pearl River
N.W. Trl. Sta.
"E"
"C"
Big Pt.
Sal Bayou
Rigolets
S.R.R. Draw
Irish Bayou
Lake St Catherine
Little River
Chef Menteur
Intracoastal Waterway
Bonnet Carre Spillway
Bayou Labranche
Kenner Towers
West End
Bayou St. John
Industrial Canal
Lake Borgne
Mississippi River
30°
Scale of Miles
0 5 10 15
20'
90°
40'

TABLE 1

LENGTH FREQUENCY DISTRIBUTION OF CROAKERS *(Micropogon undulatus)* TAKEN FROM LAKE PONTCHARTRAIN, LOUISIANA, JULY, 1953 TO OCTOBER, 1954

mm.	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
0- 9																
10- 19						19	24	12								
20- 29					2	105	65	58	88	8						
30- 39						23	26	245	251	138	10					
40- 49						5	18	244	542	363	572	4				
50- 59					1		9	54	363	405	1346	363	2	1		
60- 69	1						16	11	212	377	993	1001	20	4		
70- 79	15	1				1	8	5	126	445	1094	1481	232	150		
80- 89	77	5						2	30	320	644	1042	309	1089	33	
90- 99	123	82							19	109	174	282	201	880	88	3
100-109	138	344	13						10	38	33	76	63	722	56	101
110-119	165	609	88	5					1	19	12	14	17	339	46	373
120-129	22	526	176	61		1	1		1	4	4	13	3	14	41	225
130-139	3	125	123	126	11	1	28	5	1	3	1		4	1	6	46
140-149	1	26	25	169	31	23	98	37	32	50	2		6	2		10
150-159	1	6	8	103	41	15	58	36	89	220	3	3	1			3
160-169		14	1	52	14	4	14	23	82	283	22	31	4	2		
170-179	3	43		25	9	2	5	8	56	150	21	96	7	1	1	
180-189	9	67		5	1		5		11	60	10	101	26	7	1	1
190-199	10	73		3					10	15	8	78	36	8	1	
200-209	10	53		4	1				3	15	6	55	29	11	4	
210-219	4	26		11					1	7	3	21	19	10	1	1
220-229	7	17	2	13		1				3	2	8	10	5		
230-339	6	11	2	10								8	6	4	2	
240-249	1	4		2						1		8		1	1	
250-259	1	5		3					1	2	1	2	1	4	1	
260-269		3										4		1	2	
270-279	1	4		2								2				
280-289		4		1						1	1	7		1		
290-299	1	1	1		1					1		3		2		
300-309		2		1						1		3				
310-319		1								1	1	1			1	
320-329		2										1		2		
330-339		4								1			2	1		
340-349		3		1									2			
350-359		1														
360-369		3										1	2			
370-379																
380-389													1			
390-399																
400 409																
TOTAL	599	2065	439	597	112	200	375	740	1929	3040	4963	4709	1003	3262	285	763

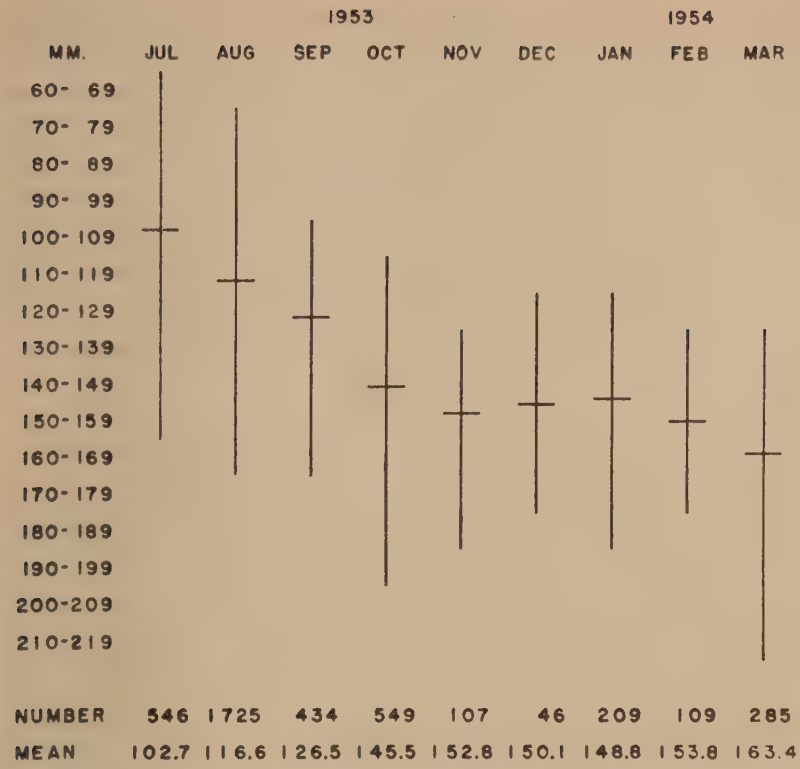

FIGURE 2.—Variation in total length of the 1952-53 spawned croakers taken from Lake Pontchartrain. Vertical lines represent approximate range and cross bars show the means.

no specimens less than 20 millimeters in total length were taken after February, it is assumed that the bulk of spawning occurred during the latter part of October, November, December and January. This assumption is substantiated by extrapolation of the length-frequency pattern in Table 1.

In addition to the above, some information on spawning was gained from an analysis of a series of trawl catches made on November 5 and 6, 1954. Sixteen large specimens were taken from the east end of Lake Pontchartrain. These specimens ranged from 208 to 388 millimeters in total length and their gonads were in various stages of enlargement. There were 14 females and two males. In the smallest male, 208 millimeters, and the smallest female, 260 millimeters, the gonads were greatly enlarged. Out of the 14 females, the gonads of six were greatly enlarged, were not enlarged in three others, and were in various intermediate stages in the rest. These limited data indicate that both sexes spawn at the end of their second year of life.

Wallace (1941) pointed out that young croakers were only found in the deep channel waters of Chesapeake Bay during their movements into the

estuarine areas. He also showed that these botttom waters were more saline and cited Cowles' (1930) work in reference to currents. Cowles reported current measurements and showed a tendency for these bottom waters to move up the bay. Of course, this would make a convenient explanation for the movement of the young fishes to the heads of bays. Other workers have attributed the transportation of young fish to the tidal currents. No specific effort was made to determine the exact nature of the mode of transportation in the Lake Pontchartrain area, but the disposition of the young was similar to that described by Wallace. Young croakers were taken only by trawl during November and December, although many attempts were made by seines in the adjoining shallow marginal waters. Furthermore, greater numbers were trawled from the deep channels than from the shallow trawlable areas. Young individuals were taken by seines from January on, and there were noticeable increases in catch per unit of effort for several months thereafter.

Figure 3 is a comparison of the monthly station samples of croakers for April, May and June, 1953. There was a more or less consistent difference between the mean lengths for the specimens taken from the various stations. One of the most outstanding examples was the comparison between the Bayou St. John and Tangipahoa River specimens. The Bayou St. John specimens averaged considerably smaller, although taken on or about the same date, with the same kind of gear. Data were available for these two stations for several other months not included in the table, and the difference was about the same. Another example, where the stations were relatively close together rather than on opposite sides of the lake, was afforded by comparison of the samples from the Northwest Triangulation Station, Pass Manchac and Tangipahoa River. The specimens from the former consistently averaged smaller than those from the Pass Manchac and Tangipahoa stations. In the samples compared, the Pass Manchac croakers averaged smaller than the Tangipahoa material, although here the difference was within the range of variation found when samples taken from the same locality with the same kind of gear at approximately the same time were compared.

In general the specimens taken from along the north shore averaged larger than those taken from the south shore area. Apparently the young croakers group in the lake after they enter and remain in more or less discrete populations throughout the spring and summer.

Age and Growth

The bulk of the croaker population in eastern Louisiana is composed of two age groups, and in agreement with Gunter (1945) individuals seldom become more than two years dlo. The croakers taken from Lake Pontchartrain and contiguous waters ranged from 10 to 388 millimeters in total length. By October of 1953 the young-of-the-year ranged from 110 to 200 millimeters in total length. The young-of-the-year of 1954 ranged from 90 to 160 millimeters and thus averaged somewhat less than the 1953 group. On the basis of the October catches for the two successive years the croakers attained a total length of from 90 to 200 millimeters in their first year.

Age determination by the scale method was found to be very difficult because of the extended spawning season and the compounding of the sculpturing on the scales due to the change in habitat, i.e. from cold brackish water, to the relatively warm saline water of the Gulf. Apparently some individuals

spend the entire first year and a half in the lake while others leave at the end of the first year, and so in a sample of two year olds there may be quite a variety of configurations on the scales which reflect these changes in habits and habitats. However, by careful comparison of scale readings, length of

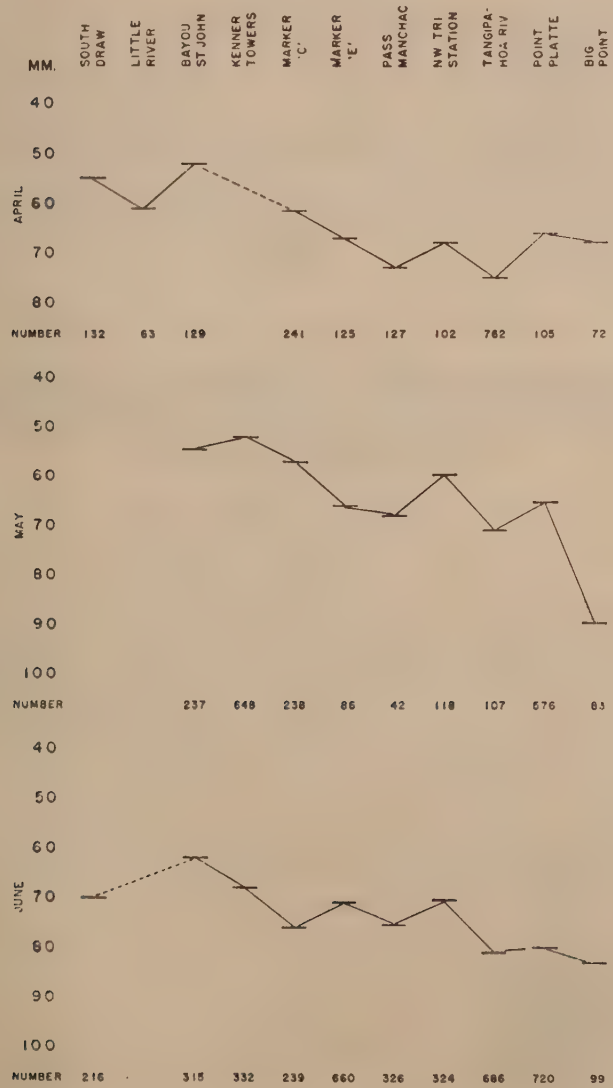

FIGURE 3.—Mean lengths of croakers *(Micropogon undulatus)* taken at monthly stations in Lake Pontchartrain.

specimens, date of samples, and the length-frequency tabulations it was determined that only a few of the specimens collected in the entire course of the study had attained the age of three years.

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Movimientos Estacionales y Crecimiento de la Corbina del Atlántico *(Micropogon undulatus)* a la Largo de la Costa Oriental de Louisiana

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Abstracto

Se recogieron datos de aproximadamente 25,000 corbina las cuales fueron tomadas del lago Pontchartrain y agas cercanas, de julio de 1953 a septiembre de 1954. Se tomaron muestras de escamas de más de 1,000 especimenes. Un microproyector se usa para facilitar la lectura de las escamas.

Estudios muestran que la mayor parte de la población de corbinas se compone de los grupos de diferentes edades. Estadísticas de las pescas indican ques las corbinas adultas se mudan del lago durante septiembre, octubre y noviembre y desovan de octubre a febrero. Sin embargo, el desove en masa ocurre intermitentemente durante el período mencionado anteriormente. Los peces jóvenes entran el lago durante noviembre y continúan moviéndose en el lago hasta marzo del siguiente año. El pez joven más pequeño que se tomó del lago midió de 10 a 14 mm de longitud total.

Una comparación de las pescas de julio, agosto y septiembre de 1953 y 1954 demuestra que los jóvenes del año de 1954 fueron considerablemente más pequeños en longitud total.

Behavior of Shrimp in an Electrical Field* (Abstract)

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Coral Gables, Florida

The response of pink shrimp, *Penaeus duorarum*, to pulsed direct current was investigated.

Shrimp were shown to respond to electrical stimuli by flipping tail first toward the positive pole.

Electrical conditions necessary to produce optimum response in shrimp are given.

Using these optimum conditions to calculate the power required to electrify a conventional shrimp trawl, it is shown that commercial shrimping with electricity is impractical at this time.

Comportamiento de lo Camarones en un Campo Eléctrico

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Abstracto

La reacción de los camarones rosados, *Penaeus duorarum*, a la corriente directa pulsada se investigó.

Al principio los camarones respondieron a estímulos eléctricos lanzándose con la cola hacia el polo positivo.

Condiciones eléctricas necesarias para producir el mejor efecto se dan en este manuscrito. Se usaron estas condiciones óptimas para calcular la fuerza requerida para electrificar una red de camarones de arrastre, y se ha demostrado que la pesca de camarones comercialmente por medio de electricidad no ofrece posibilidades prácticas en esta fecha.

Laboratory Experiments with Shark Repellents

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During the course of an investigation of shark repellents, one phase of the study was carried out at Woods Hole, Massachusetts, during the summer of 1942, on live dogsharks, *Mustelus canis*, held in tanks. The results of the study formed a basis for a continuation of the development of a shark re-

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pellent. It is the purpose here to report briefly only on methods used in experiments with the live dogsharks in tanks, and on some of the conclusions that are of more interest to biologists than to those concerned with practical applications of shark repellents.

This experimental phase in the development of a repellent was carried out under contract to the Committee on Medical Research of the Office of Scientific Research and Development by Marine Studios, Inc., of St. Augustine, Florida, under the personal supervision of W. Douglas Burden as responsible investigator. Since quick results were essential and since no previous work had been done toward the development of a repellent, the first action was to cover the field as broadly as possible to find any chemical or physical means that would keep sharks from attacking men in the water. A great number of possibilities were set down as being worth some testing on dogsharks in tanks. With the late Arthur F. McBride, the writer was assigned to make a preliminary evaluation of these possibilities. It was soon found that the services of a chemist were required, and Dr. David Todd was added to the team.

A general design for experimental procedures was set up within a week after our arrival at Woods Hole, about the first of July. This was done after consultation with several people, and the primary consideration was expediency. It was apparent that a large number of dogsharks would be required because of the probable loss during experimentation through use of devices or materials injurious to dogsharks. Of course, practical considerations limited the kind of device or material to be tried to something reasonably safe for use by a man in the water.

Our collection and handling of the dogsharks in sufficient numbers would not have been successful except for the fine help given by the authorities of the Marine Biological Laboratory and the Woods Hole Oceanographic Institution, particularly Mr. James McInnis and Mr. William Schroeder. Throughout the period of planning and experimentation assistance was given freely by so many that listing them is impractical.

Laboratory Experiments

Suggestions given by experimentalists that very young dogsharks might give evidence of erratic behavior (see Parker, 1914, p. 64), inconsistent from day to day, and therefore unsuited to our purposes, proved correct. At least, all of our attempts to get reproducible results with dogsharks under 18 inches long failed. We did not collect a sufficient number of adult dogsharks for our work and nearly all of the sharks used in regular laboratory experiments were from 18 to 30 inches in total length.

The dogsharks were collected by hook and line fishing near the laboratory docks, and were transported to the laboratory in live cars. They were immediately transferred to holding tanks in the laboratory where running sea water was available. The supply of sea water remained within one degree of a constant temperature during the experimental period from July to Septemper and may have been an important factor in the success of experimentation. At least a subsequent attempt to repeat experiments at LaJolla, California, with a related species of *Mustelus,* failed, and a notable difference in the situation was a fluctuating temperature of the water supply.

The dogsharks at Woods Hole were kept in the holding tanks for a few days and were fed sparingly on pieces of fresh mackerel. Small sharks, sharks

with apparent injury, or sharks that refused food for several days, were discarded. Lots of four to six individuals were selected for experiments and transferred to the experimental tank. The experimental tank, located in the basement of the Woods Hold Oceanographic Institution, was of wood, painted white inside, and about five feet wide by 15 feet long, with running sea water maintained at a depth of about three feet. The dogfish put into the experimental tank were fed regularly at ten o'clock each morning with one-inch square pieces of filleted fresh mackerel, placed on the outside of a wire mesh box, which was about a four-inch cube situated near an end of the rectangular tank. After it became apparent that the dogfish were feeding regularly and appeared to be in good physical condition they were used for experiments.

Parker and Sheldon (1913) and Field (1907) reported no success in getting *Mustelus* to feed in tanks and their experiments were undertaken in open pools. The explanation of our success in getting *Mustelus* to feed voraciously in tanks may be in the better water supply available in 1942 at Woods Hole. In retrospect, however, it seems more probable that our selection of uninjured fish that appeared alert and especially active may have been of paramount importance. Parker and Sheldon note that their *Mustelus* were caught in traps. Ours were taken on hook and line. Personal experiences in keeping marine fishes alive in tanks suggest that fish taken by hook and line, if not severely injured by the hook and if carefully handled, show less evidence of shock than trapped or netted fish. The above authors also kept *Mustelus* in a pool for a period of 10 days in order to bring about a state of hunger. Our fish, on the other hand, were offered food as soon as they reached holding tanks, although feeding often did not take place until the second or third day after capture.

At the beginning of our observations we found that our experimental group of dogfish would normally be swimming slowly on an elliptical course around the tank at the approach of feeding time and furthermore that spacing of the individuals was random, or about uniform. That is, the sharks did not exhibit a tendency to keep together as a group. We also found that a piece of mackerel sinking past their eyes did not interest them immediately and that a delay in reaction to the food could be explained on the assumption of an olfactory stimulation. Some experiments of Parker and Sheldon (1938, p. 39) using baits and blanks (pieces of rock) wrapped in seaweed were reproduced. The work of Budker (1938) indicating a gustatory stimulation in sharks through special receptors on the head was overlooked at the time, but shows that we were not correct in assuming that all of the stimulation initiating a feeding response by our experimental sharks was olfactory. However, the organ, or organs, through which a stimulus for feeding was received by our groups of experimental sharks was of less importance for our study than the fact that the stimulus was produced by diffusion of juices through the water, as shown not only by the work of Budker but by earlier experiments by Sheldon (1909), Parker (1914), and others. Later observations during field studies carried out by Springer and others, that several species of sharks characteristically bump floating inanimate objects with their snouts while searching for food, are easily explained if it is assumed that the shark is testing for juices that indicate the object is edible.

We found by watching our experimental groups after food (always a one-inch square of mackerel fillet) had been put inside of the wire cage and placed

in the tank, that the reactions of the dogfish could roughly be classified by the apparent intensity of their response. The first response of each shark after apparent first detection of the presence of food was an abrupt turn out of the normal elliptical course around the tank into a tight circle around the food. We called this a hunting turn, although it probably is the normal response to any stimulus leading to investigation on the part of the shark. Frequently the shark would return to the elliptical course around the tank without an attempt to close in on the bait, but sometimes would approach and bite the wire mesh box, or even pick it up and shake it.

Since it was necessary to determine the effectiveness of a great many materials, at least on a comparative scale, a kind of biological assay was set up to compare the effectiveness of various substances in stopping the feeding of our dogfish. To do this we arranged a series of tests, each test to run for ten minutes. The first test and alternate tests thereafter were made using a piece of mackerel inside the wire box. The second test and alternate tests thereafter were made with a piece of mackerel inside the box in addition to the material being tested. A rest of ten minutes or more was allowed between each test and the wire box with its content was removed from the water at the end of each test. Fresh food was used for each test. The turnover of water in the tank during the period between tests was far from complete and the accumulation of dissolved materials from the food and from the materials being tested probably were sources of error. For each test one or two observers who had watched the dogsharks long enough to recognize them as individuals were given score cards. They were told to score numerically the results at the end of each minute on the entirely arbitrary basis of one for each hunting turn made by any dogshark during that minute, two for any dogshark biting the wire box, and five for any dogshark picking up the box and shaking it.

The figures were convenient because the total for a ten minute test using food alone was always a figure near 100, and because the results were reasonably consistent from day to day with different observers. The figures also were convenient because by comparing the figure for any given substance being tested with the mean of the preceding and following tests which were always made with food alone, we could arrive at a figure which we regarded as the percentage of effectiveness for that particular series of tests.

There were several interesting trends in these test series. Testing was ordinarily started at ten in the morning and a series of tests were made without interruption except for ten minute rest periods. The values obtained for controls; i.e., for tests with food alone, increased regularly for one to two hours and then decreased. The increase, reflecting increasing response on the part of the dogsharks, normally reached a figure about 20 per cent higher than the starting figure. Ordinarily we stopped testing for the day after figures for control tests returned to the starting figure. Only once were the tests continued beyond this point. On that occasion, reached about four hours after the testing started, the dogsharks' responses became very weak so that there was no sharp distinction between controls and tested materials.

In each 10 minute test with food alone or in each test of materials relatively ineffective in inhabiting feeding, the greatest scores were obtained during the third or fourth minute and again between the seventh and ninth minute. That is, during each test period there were two flurries of attack on the food in which all of the experimental group of dogsharks took part. What-

ever the explanation, the pattern is similar to attacks by groups of predators. Tests with feeding inhibitors present were characteristically without flurries of concerted attack. Our method permitted the comparison of a large series of materials for effectiveness in stopping the sharks from feeding.

High and low frequency sounds, fish poisons such as rotenone, irritants such as chlorine, metallic poisons, chemical stenches, and poison gas generators were tried on our experimental groups of sharks, with no success. A great many of our sharks were killed, but either the amount of material required to protect the food was excessive or the sharks ate or tried to eat the food before dying, or while dying. It became evident that we needed a substance that would be effective even in very small concentrations.

In general, our tests indicated that almost any substance even slightly soluble in sea water, and not a food, reduced the feeding responses of the dogsharks. A few substances were neutral or even slightly attractive. Very few substances strongly reduced the responses. Several of the organic acids, notably maleic acid and malic acid occasionally inhibited feeding completely but results were not consistent. The most consistent results were obtained by use of shark flesh allowed to stand at 20° centigrade for four to six days, and with small concentrations of copper salts. Ethyl alcohol extracts of four to six-day-old shark flesh inhibited the dogshark feeding responses, but the results with extracts were not so dependable as those with shark flesh.

General Observations from Experimental Procedures

The importance of the use of dogsharks that had become adjusted or conditioned to the tank environment was obvious throughout this experimentation. By the use of properly conditioned dogsharks of sufficient size a predictable behavior pattern in the presence of food was observed. No material was found that in small concentrations had such an obviously irritant effect as to drive the sharks away from the food. However, it was observed that many soluble materials inhibited the feeding responses of the dogsharks. Considerable difficulty in obtaining consistent results with feeding inhibitors was encountered, perhaps due to the complications of diffusion of complex chemical materials in sea water. Consistent results were obtained by the use of shark flesh that had been allowed to stand for four to six days at room temperature. This material inhibited all feeding responses.

The test procedures indicated that all responses of the experimental sharks to the presence of food were initiated by the diffusion of juices in the water affecting either or both the olfactory or gustatory organs. However, there were also indications that a secondary stimulus, provided by a change in the rate of movement of the first shark turning on the food, produced a group response resulting in concerted attacks.

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Experimentos en el Laboratorio con Repelentes de Tiburones

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Abstracto

Se describen los metodos usados en experimentos hechos en el laboratorio con tiburones vivos, *Mustelus canis* con énfasis en la descripción del procedimiento usado en la colección de los tiburones en Woods Hole, Mass. en el verano; también se describen los métodos de acondicionamiento de los tiburones para trabajos experimentales. Se hicieron ensayos biológicos de la eficacia de varias substancias que inhiben la alimentación de los tiburones.

Some Problems Concerning the Management of the Shrimp Fisheries

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The purpose of this paper is to point out some of the problems encountered in management of the shrimp fisheries. For orientation purposes, a few general statements about shrimp fishing in estuarine waters, and overfishing will be mentioned.

Although natural conditions, such as severe freezes, like the one of January 1940, may cause a sufficient reduction in spawning individuals to affect the crop produced, we have not seen any indication where trawling at sea can do this. Apparently, up to now, fishing becomes unprofitable before the numbers of spawners can be reduced sufficiently to affect the crop produced by these spawners. Consequently, if a depleted level is defined as the point below which there is a direct relation between the number of spawners and the resultant crop, it is not necessary, under present conditions, to fear depletion in the shrimp fishing.

The environmental requirements of different species of shrimp are quite distinct. The white shrimp, *Penaeus setiferus*, is rarely found in depths greater than 35 fathoms, whereas the brown shrimp has been taken at around 100 fathoms. The white, and probably the brown and pink shrimp in the Gulf of Mexico require an estuarine phase early in their lives. On the west coast of Mexico we find that *P. stylirostris and P. vannamei* seem to require an estuarine phase, but that *P. californiensis* may not require more than a coastal phase and, perhaps, *P. brevirostris* spends its entire life at sea.

Tagging experiments have shown that there are separate and distinct stocks of white shrimp. It is likely that there are also distinct stocks of pink and brown shrimp. As a consequence, it seems evident that shrimp cannot be treated as a unit when we consider their management. Probably each species and each stock of a species will have to be treated as a separate entity.

Now, let us examine the problem of fishing in estuarine waters. Unless otherwise specifically mentioned, these remarks will pertain only to the white shrimp, since we know more about this species. The white shrimp spawns at sea and the young at an early stage must reach the coastal estuarine waters else they perish. Spawning in Louisiana begins the latter part of March or early in April and continues until about October, with a peak probably in June or July. Although spawning appears to be continuous, the numbers of young entering the fishery as a result of spawning are not continuous.

Young shrimp appear in the estuarine fishing grounds in waves. These are generally three in number. The first two major waves produce the summer and fall estuarine catch and the fall and winter offshore catch. The last wave produces the winter and spring estuarine catch and the spring and summer offshore catch.

When the young first enter estuarine waters they appear to inhabit the peripheral areas, that is the margins of the bays, the marshs, and smaller bayous. In summer, at about two months of age they leave the peripheral zone and move into the larger bodies of estuarine waters and eventually find their way offshore where they spawn at about the age of one year.

It is interesting to speculate on the causes of the waves of young shrimp. The answer to this is not known but the production, or beginning of success, of the second wave can be associated with the movement of the first wave from the peripheral to the central nursery area. The success of the third wave can be associated with the movement of the second wave from the peripheral to central nursery area, together with the movement of the first wave to offshore waters. There is, therefore, a possibility that the shrimp may be its own worst enemy. If this be true then it could be presumed that a certain amount of thinning or fishing on the inland grounds would be beneficial.

There are various problems that arise when we consider thinning on the nursery grounds. Some of these are:

1. Since the first estuarine areas inhabited by young shrimp are peripheral, where the shrimp are not now fished and where they are too small to be of any commercial importance at present, what effect does thinning on the central nursery grounds have on the crop production of the peripheral nursery grounds? In other words can thinning of the population on the central nursery grounds produce more shrimp on the peripheral grounds, thereby leveling off the waves and producing a more continuous supply of shrimp?

2. It is probable that the numbers of shrimp on the central nursery grounds are limited by the food supply available to them. If this is true, then it is also probable that a certain amount of thinning on the nursery grounds would be beneficial in that excess shrimp could be removed from the estuarine areas and still leave a good crop to move offshore. The problem here is to determine what amount of thinning in estuarine waters is beneficial.

3. We are working on a somewhat similar problem in southern Sinaloa and Nayarit on the west coast of Mexico. In this area, for many years, shrimp have been trapped in weirs called *tapos*. In general the *tapos* catch the shrimp as they are moving from one place to another on the nursery grounds. The runs of shrimp are at night and are associated with the low tides occurring near the full and new moons. In studying the *tapo* catch

records we find that interseasonal production may vary as much as 700 per cent. Some of this variation, but by no means all of it, is associated with differences in seasonal rainfall. The interesting point is that in adjacent areas at sea there does not seem to be such large fluctuations in the population of shrimp arriving at sea. It appears that some vast leveling mechanism must be occurring on the nursery grounds, which would indicate that perhaps a certain amount of thinning might be beneficial, or at least some thinning could occur on the nursery grounds without seriously damaging the production at sea.

4. Natural predation, other than cannibalism, seems to be quite important in the estuarine areas. For example, last year we tried to tag shrimp in *tapo* areas to find out where they went at sea. Although we tagged about 5,000 shrimp, not one was caught at sea. Some of the mortality was caused by the small size of the shrimp tagged but apparently much of the mortality could be attributed to predation. The marked shrimp we released were the only shrimp escaping from the *tapos* and there were always countless thousands of catfish and other fish awaiting our tagged specimens even though we would release them at some distance below the *tapos*.

For this reason the use of the shrimp trawls seems preferable because they catch not only the shrimp but also the fishes preying upon the shrimp. Depending upon mortality ratios, it is readily conceivable that a certain amount of trawling in estuarine waters might be beneficial, owing to a reduction in the number of shrimp predators resulting from this trawling.

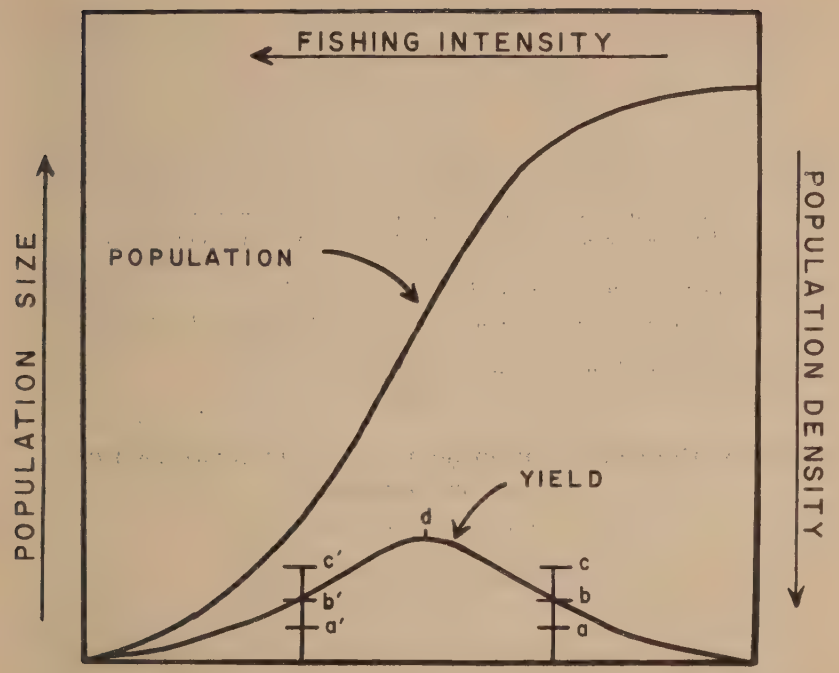
The point made here is that the evidence to date indicates that complete closure of estuarine waters to fishing probably would not be beneficial with respect to shrimp production. On the other hand excessive fishing in estuarine waters can definitely affect the production at sea. The problem is to find out to what extent should fishing in estuarine waters be permitted. Here again we encounter more problems.

In Louisiana, from about the first of April until the end of October growth of shrimp in estuarine waters is extremely rapid, but for about five months of the year, from November through March, there is little or no growth. It is obvious, therefore, that unless there is considerable difference in the magnitude of natural mortality between the rapid growing season and the slow growing season, these two periods must be considered separately with respect to estuarine fishing.

As you can see we do not yet know enough about shrimp to advise what properly should be done with respect to fishing in estuarine waters. It does seem that both complete closure of estuarine waters and excessive fishing in estuarine waters will result in a lesser total poundage of shrimp than if some fishing is permitted.

Since we need not fear depletion, our problem then is that of managing the crop. When we get into this field we find the problems are not purely biological, but also include problems involving sociology, economics and politics. As a consequence we should have a precise idea of our objective. Is it the maximum tonnage of shrimp the crop can produce? Is it greater profits to the industry? Or, is it the maximum number of persons to be employed in the industry? Each of these represents different goals which must be attained by different means.

According to modern fishery theory a fishery develops as the result of com-



plicated interrelations between two sigmoid growth curves, one representing growth of a population of fishes and the other the growth of an industry. The growth of a fishery is limited both by the market for the product and by the size of the fish population. This can be more easily understood if we follow what theoretically happens to a population of fishes being fished as illustrated in the figure. The "S-shaped" curve represents the size of the population of fishes and the "bellshaped" curve represents the yield or equilibrium catch at any point on the "S-shaped" curve. The "S-shaped" curve is merely a summation of the "bell-shaped" curve. As you can see from the illustration, as fishing effort increases the population density decreases or, in other words, the catch per unit of effort (the catch per boat-day) declines. Also, as fishing effort increases the total yield increases to a maximum (d in our illustration) and then decreases as more effort is thrown into the fishery. Furthermore, if the catch is less than the equilibrium yield the population size will increase (a and a^1); if the catch is equal to the equilibrium catch the population will remain constant (b and b^1); and if the catch is greater than the equilibrium catch (c and c^1) the population size will decrease. From this it follows that by fixing or regulating fishing we, theoretically, can regulate the population size and the yield at any point on the curve we may choose. Generally, this is more easily said than done.

With the shrimp, for instance, if we define overfishing as a condition that exists when profits from fishing are less than profits from other industries,

we find that overfishing is highly relative, depending on both the density of shrimp and upon economic conditions. We could, with suitable conditions, have overfishing at any place on our yield curve. Overfishing could occur at b or it could occur at b^1, and the total catch or yield would be the same in each case. The catch per unit of effort, nevertheless, would be considerably greater at b than at b^1. In addition the effects of regulation would be different in each instance. Regulations at b^1 would provide for a subsequent increased yield with less fishing, whereas at b the yield could be increased only by increasing fishing. Hence it would seem that we need to have a rather concise idea as to where the shrimp stocks stand with respect to population dynamics before we can be assured of the results of regulation. This information is not yet available.

Enough is known about shrimp to realize that we do not yet know how best to regulate fishing for them. More information is required on their biology and on population dynamics.

Algunos Problemas Concernientes a la Administración de la Pesca de Camarones

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Abstracto

Cada especie de camarón tiene que ser tratada como una entidad separada puesto que todas tienen requisitos distintos. Uno de los problemas es el determinar si la pesca en los criaderos es beneficiosa y produce más camarones en las zonas vecinas. En la costa occidental de Méjico la producción en los criaderos puede variar hasta 700 por ciento de un año a otro. No parece haber esas mismas fluctuaciones en las poblaciones de camarones que arriban en el mar. Se marcaron 5,000 camarones en los criaderos pero no se pescó ni uno de estos en el mar, y aparentemente la mayoría de la mortalidad se debe a peces voraces. Cierta cantidad de arrastres en los criaderos puede ser beneficiosa ayudando a reducir estos peces voraces. La evidencia en esta fecha indica que la clausura de aguas estuarias no sería beneficiosa con respecto a la producción de camarones. Por otro lado se puede decir que la pesca excesiva en aguas estuarias puede afectar definitivamente la producción en el mar.

DISCUSSION

Biological Session

Discussion Leader: Paul S. Galtsoff

Discussion Panel: Gerardo Canet, B. F. Osorio-Tafall

A Comparison of Nova Scotia and Bahamas Bluefin Tuna with Reference to Migration and Population Identity

Luis Rene Rivas

Q. Osorio: How fast can a bluefin tuna swim?

A. Rivas: I don't know. In 1938 a man equipped his reel with a speedometer and went to Nova Scotia to obtain information about the speed of this tuna. He found out that the speedometer showed 45 miles per hour when the tuna was hooked and frightened. This may be open to question. We usually fly over the Bahama waters around noon. We can see the schools clearly from an altitude of 500 feet, and in the early part of the season it is possible to pick out a solid school, which could not be confused with anything else and follow it from around Orange Bay all the way up to Great Isaac. Timing about a 12 or 15 mile run, the average speed came to about 3.3 or 3.5 knots. Sometimes we've timed them to 4 or 5 knots; sometimes much slower. The bursts of speed which people sometimes observe might be caused by frightening the fish. Judging from the time it takes the tuna to get from the Bahamas to Nova Scotia waters which is about 16 days, the rate again comes to about 3.5 miles per hour.

Q. Canet: What type of research should be conducted in Cuban waters to assist in the exploitation of a tuna fishery?

A. Rivas: You have heard the results of the work in the Gulf of Mexico by the Fish and Wildlife Service, as reported upon by Mr. Harvey Bullis. The first step is to get long lines and all other types of gear and explore the waters around Cuba. Once you have established the fact that there is an exploitable population of tuna then the investigations should be pursued on the assessment of the population, the fishes migratory habits, their breeding seasons, the times of the year when the fish are more abundant, and a routine life history investigations.

Q. Moore: Mr. Rivas mentioned that the final proof of the migration of this tuna from the southern waters to the northern would be tagging. I am curious what techniques might be employed.

A. Rivas: We started our tagging program in 1952 in cooperation with the Woods Hole Oceanographic Institution represented by Mr. Frank Mathers. We decided that by using hooks with a very fine leader we could sink the hook deeply in the jaws of the tuna and the leader wire would

break, automatically releasing a tagged fish. With the cooperation of the sportsmen, we succeeded in tagging about 35 fish by that method.

Q. Mather: I think it might be profitable to put more effort into tagging. A new style of tag developed by the California Fish and Game in the Pacific tuna investigation gave us new hopes on the possibility of tagging our tuna successfully. We tried their method this summer and got one return from the sixth fish we tagged. We've modified that tag a bit so it could be applied to large tuna without bringing them into the boat. Mr. Rivas, I have heard from very reliable witnesses that tuna schools are seen feeding at Walker Key, a short distance from Bimini. You mentioned that they started feeding off Jersey. I wonder if you could give an opinion whether that is where they really start feeding?

A. Rivas: The stomachs of practically all the specimens caught in the Bahamas are empty. In addition the stomachs are shrunk, so there is evidence that these fish do not feed there. Where they begin to feed after leaving the Bahamas, I don't know, but it is reasonable to assume that these tuna fill up with mainly herring and mackerel in northern waters.

Smith (Comment): It might be in order to point out some rather broad implications of this tuna migration. It was not until comparatively recent years that the tuna had even been seen going through the Florida straits, and yet there is no reason to believe that they had not been going through there in very considerable numbers for a long period of time. They were there, but nobody had seen them. So, there is a very considerable stock of potentially commercial fish that was not known. If we trace this migration back, there exists a strong possibility that it begins somewhere in the Caribbean Sea. In that case there must be a very considerable tonnage of these pelagic migrants in the Caribbean which have not been seen except possibly by Mr. Rivas and his associates, when they are flying there deliberately looking for them. The importance of this is that in the northern hemisphere at least, where the demersal fisheries of the continental shelf have been pretty completely explored, if we're going to look for a greater production of fish we have to look to these pelagic migrants. Therefore, I think that any study of the patterns and mechanisms of migrations in the case of a fish like the bluefin tuna has implications which extend far beyond this particular species.

Rivas (Comment): I would like to add something concerning the movements of bluefin tuna after they leave Nova Scotia waters in the fall. The general consensus of fishermen was that after the tuna left Nova Scotia in the fall they went directly east, over to Europe. European tuna have a migra-

tory pattern very similar and simultaneous with our western Atlantic tuna. We now know that our tuna spawn in the Straits of Florida during May and June. In the Mediterranean the same thing happens, 4000 miles away, during May and June. Then our big tuna disappear from here and big tuna disappear in the Mediterranean too. Later, behavior is likewise similar in the two groups. In the past two or three years we have been trying to follow our fish on their southern migration by flying out of Bermuda and Puerto Rico and the coast of South America. We've been fortunate enough to pick up a few going south off Bermuda and off Cuba in February, off Puerto Rico, off the island of Tobago and off the coast of South America. Over the Bahama banks we've seen schools of tuna going south out of the Tongue of the Ocean in December. The same thing apparently happens in Europe, so there are two separate simultaneous north and south migrations every year.

Q. Wheeler: Is there anything known about the nocturnal movement of tunas?

A. Rivas: I'm still waiting for an opportunity to fly off the Bahamas at night. So far I don't know whether they move at night.

Q. Wheeler: Do you have any idea what guides the tuna in their migratory behavior?

A. Rivas: I have an idea that they may use sunlight to guide themselves but we know very little about it.

Q. Wheeler: If we assume that light is a consideration in their migratory pattern, then this would surely rule out nocturnal movements, would it not?

A. Rivas: No, because once they had started in a given direction they would keep going in that general direction. Ocean currents seem to affect their migration patterns. Another interesting thing is that these tuna seem to be within a certain isotherm all the way from the Caribbean to the Florida Straits where they spawn. Once the spawning is over they start north and apparently don't pay any more attention to isotherms in temperature. They go in 2 or 3 weeks from temperatures of 28 or 29 degrees Centigrade into waters which are 16 to 18 degrees Centigrade.

Mowbray (Comment): This is a suggestion to answer Dr. Canet's question about tuna investigation in Cuba. It is my opinion that the majority of the bluefin tuna which go by the Bahama's shore migrate past the north shore of Cuba, from the east. I think they come up the old Bahama channel. There is a migration by Bermuda simultaneously with the Bahamas one, and my opinion is that those go in a direct line through Mona Passage or the Windward Passage. I believe if some aerial observation could be carried out in the shallower waters near the eastern and east central portion of Cuba, on the north shore, from about the 15th day of

May to the middle of June, I suspect tuna might be encountered. Whether they can be exploited can only be answered by trying. This year in the Bahamas tournaments they caught 80 to 90 fish during the tournament, and they were wasted, whereas 80 to 90 500 pound fish in Cuba could be utilized. Also, the yellowfin tuna appear off the south shore of Puerto Rico, and I am quite convinced that if long lining were tried off the south coast of Cuba that results would be comparable to those found in the U. S. Fish and Wildlife Service investigation.

Rivas (Comment): We have from the air explored the Bahama channel and the waters all around Cuba for three years, and we have never seen a tuna in that area.

Mowbray (Comment): The reason I seriously believe there may be a migration through the Bahama channel is that Bernard Wheelam tells me bluefin tuna migrate past the coast of Venezuela. It is reasonable to suppose that those fish go around the western end of Cuba, but there is no reason to assume that when they come through the Florida Straits they would cross the Gulf Stream to go up the eastern side of the strait. I still believe that they come up the eastern side of the strait. I still believe that they come up the eastern side through the old Bahama Channel.

Growth Rate of Sub-Populations of Mullet *(M. cephalus)* On the West Coast of Florida

Gordon C. Broadhead

Q. Lindner: What was your method of measuring the tagged mullet when released and upon recovery?

A. Broadhead: The original measurements were made on live fish, of course, and the final measurements on dead fish. I adjusted the final length because of shrinkage which always occurred, due to freezing or handling. This ran around 1½ per cent, but even after this adjustment, I still had a slight "negative" growth on some individuals probably due to greater than average shrinkage, or to inaccurate measurements.

Lindner (Comment): On our shrimp we also got mostly negative growths after short periods too, but I think it was the method of handling, most of them being preserved in formalin.

Q. Van Engel: How were the recaptured tagged mullet recovered? Did you get them from the commercial fisheries from sport fishermen, and if so how did you ask them for the information? It's something that is not very well done in other places, and if we could learn something from your method it would be worthwhile.

A. Broadhead: The recaptured tagged fish come principally from the commercial fishery. Fishermen have been alerted to watch for the fish by personal contact, newspaper publicity and

posters in the fish houses. Mimeographed forms in the fish houses give instructions on how to handle tagged fish caught, and dealers are asked to pay rewards and hold the fish in freezers. The tag bears return instructions too. However, the only certain way to get tagged fish back is with frequent and repeated visits to the fishing areas.

Q. Eddie: Formerly there was quite a mullet fishery carried on in Lake Thorn in Louisiana by Florida and Alabama fishermen. The fishermen came there in the latter weeks of October and caught these migrating mullet heavily laden with roe. This year we encouraged fishermen in Louisiana to fish those mullet, and the fish appeared in the French market for the first time. They were large mullet, up to five pounds, and I wondered in view of the fact that Florida fishermen have had a problem selling small mullet why they had not returned in the Louisiana fishery.

A. Broadhead: Actually the price being paid for large fish now is running from 8 to 10 cents a pound whereas in 1950 the price was as high as 18 cents. So even big mullet do not demand a good price now.

Q. Eddie: Can you throw any light on the area in which the mullet spawn? We are unable to find spawning mullet in the inshore areas.

A. Broadhead: This point has never been been established definitely. Some of our indirect evidence points to an offshore spawning. In our tagging program we examine the fish carefully when they are tagged, and on many occasions in the tagging record it was noted that certain fish were fully ripe, that is either the eggs or the milt were observed. About half of a dozen of these were returned from the commercial fishery in a period of less than two weeks. The fish were from schools that were running offshore, and when the fish were recovered they were taken on the outside, suggesting that they were moving offshore to spawn.

Q. Eddie: The consensus among the fishermen in Louisiana is that the mullet which has already spawned does not return.

A. Broadhead: This does not seem to be right. We have had many fish returned after the spawning season which were tagged several months prior to the spawning period. In fact, the rates of tag return from taggings made during the spawning runs are just as high as are the returns from taggings at other times of the year.

Seasonal Movements and Growth of the Atlantic Croaker *(Micropogon undulatus)* Along the East Louisiana Coast

ROYAL D. SUTTKUS

Q. Galtsoff: Is the increase in the observed average size explained by the movements of fish to different areas as they grow?

A. Suttkus: Taking a particular year, say 1953, the earliest spawned individuals produced in October, are the first to move out starting in September, October and November of the next year, along with the year class before this, which is the 1952 group. The latter are the individuals resulting from the later spawning, even as late as January and February of 1952. Later spawned individuals, however, will remain in the lake at times as late as November, December, January or February of 1955 more and more of those individuals will move out, leaving the smaller ones in the lake. Thus sampling in the lake does not reflect the size composition of the population.

Q. Eddie: Is the age and the size of the croaker that urges him to move, or is there a correlation between the spawning migration and the season?

A. Suttkus: Temperature can be correlated very nicely with the movement of the bulk of the croakers out of the lake.

Q. Eddie: The hook and line fishermen have also noticed that when croakers migrate in September and October the bulk of the catch is of females. Is there a separate migration or do they migrate simultaneously?

A. Suttkus: The sexes migrate at different times.

Van Engel (Comment): The distribution of croakers is a very interesting subject to us in the Chesapeake Bay. We have had an investigation on the croaker for a number of years. Mr. Dexter Haven of our Laboratory has found large numbers of small croakers at the head of the tide in the rivers of Virginia. In the York River the small croakers of sizes down to about 10 mm. are found December, January and February in a salinity no more than half a part per mill. Also, the number of croakers in Chesapeake Bay and the size of each of the individual fishes may be dependent upon the strength and direction of the tidal currents not only at the mouth of the capes but also in the rivers.

Behavior of Shrimp in an Electrical Field

James B. Higman

Q. Galler: I gather from the summary of your paper that there is no future for electrical fishing in the shrimp industry. I had a definite impression that the Germans are using electrical fishing in the North Sea with a marked degree of success. What is the difference between their type of fishing and shrimping which makes electrical fishing feasible in Germany?

A. Higman: The German fishing has been experimental and not on a commercial basis. This equipment has since been brought to the United States by the menhaden interests with the idea of catching menhaden at sea. It has not, however, worked as yet on a commercial basis.

Q. Galler: Are the calculations for the amount of amperage and

voltage required based on the type of equipment used in your experiments or are they based on equipment using condensors where it is possible to obtain a tremendous build-up of current?

A. Higman: The power requirement were calculated on the basis of the optimum electrical conditions found in the experimental work.

Q. Osorio: Have you observed any change in reaction after several successive stimulations? Also, what was the effect of size and sex on the reaction of the shrimp to the electrical field?

A. Higman: The stimulation of the fish or shrimp by an electrical impulse is inversely proportionate to their length. It was necessary to use similar size groups in all the tests. Perhaps in this phenomenon we have a conservation measure through selection of the size groups to be taken by the commercial fishery. There was no difference between the sexes in reaction to the electrical stimulus. Preliminary tests showed that you could not run the same batch of shrimp twice, as successive tests rapidly weakened the response.

Q. Menzel: Would the electrical equipment be used on a trawl or would a net type of shrimping gear be necessary?

A. Higman: Some very fundamental work with electrical equipment must be done before it can be applied commercially. Initially we had thought of electrifying a trawl, although not to compete with the standard shrimp net fishing on known shrimp grounds. We did have in mind a pelagic trawl, for fishing above bottom.

Experiments With Shark Repellants

STEWART SPRINGER

Q. Osorio: In my early years in the northwest of Spain, I learned of the fishermen's tradition that the best repellent for sharks is a rotten shark. I would like you to elaborate some more about this possibility. Also, how do you think sharks which you tested in tanks would react in the natural conditions to the same stimuli?

A. Springer: I would like to answer the last question first. After doing this work with sharks in tanks, experimentation with the sharks in the field was continued for approximately two years, and it was my observation that the sharks in the field reacted very much as did the sharks in the tanks. In the field some additional compounds were found that were effective as feeding inhibiters for sharks. Unfortunately these have been called "repellents", but none of them actually drive the sharks away. The inhibition of shark feeding doesn't even prevent the shark from coming up and bumping the bait. That is a common activity of sharks, and they do it in checking to see if the object is edible.

Presumably they knock a little bit of the material off so that they can judge whether it is edible. Some sharks, such as the tiger shark, will eat *almost* anything—garbage, old shoes and pieces of wire, tin cans and so on—whether or not there is any nourishment in it.

Q. Moore: I believe the implication of your last remark is that the tiger shark will not be deterred by the shark repellent.

A. Springer: We never did get a chance to check on the tiger shark. Unfortunately—or fortunately—they are nocturnal and are extremely cautious. I think that this inhibition involves an automatic reaction. We shouldn't think of sharks as operating on the same level as we do; since their nervous organization is entirely different.

Q. Galler: When was this work conducted?

A. Springer: It was conducted in 1942, between July 1st and some date in September, when the onset of cold weather kept us from getting any more sharks. The use of sharks in tanks is quite complicated and difficult. It is difficult to get enough sharks, and difficult to get them properly adjusted to tank life. These were the limiting factors on the work at Woods Hole—time ran out on us and we had to go on to something else, without answering a lot of questions that come up.

Q. Galler: Are you familiar with the work done recently in Hawaii using irritant substances that effect either the olfactory organs or the eyes of fish and appear to be quite effective with some kinds of fishes?

A. Springer: We tested thiocyanates extensively on dog fish and didn't get favorable results. Substances that are effective on sharks are often not effective on bony fishes.

Q. Franco: You said that the shark flesh was held for four to six days at room temperature. I would like to know what this temperature was.

A. Springer: Approximately 20°C. The shark flesh on being exposed to decomposition becomes slightly alkaline and evidently there is a breakdown, giving off ammonia. One might think that ammonia was the substance that acted as the repellent. Apparently it was not. Neither was trimethylamine or several other of the common decomposition products. We are still not sure what is the essential compound although chemical studies by Dr. Todd indicated that they were organic acids. Almost no other common animal, on decomposition, becomes alkaline. In mammals or reptiles the flesh becomes slightly acid on decomposition.

Q. Wiles: Would a shark 6 to 10 feet long exhibit the same behavior as your trial specimens of 30 inches? I have noticed from my personal experience that sharks of that size are very reluctant to take bait while sharks 5 to 8 feet long go for it. Do you think that the bigger shark would react as cautiously as your smaller shark?

A. Springer: That depends on the size of the bait or of the object being taken. I suspect that all sharks are reasonably cautious when confronted with something of their own size, whereas they have no reason for caution with something small. About 1940 I published an account of the contents of the stomachs of some 200 sharks of the species *Carcharhinus milberti*. This was interesting in that the larger sharks, about 10 feet long, had eaten whole groupers of considerable size whereas the smaller sharks had eaten smaller groupers.

Butler (Comment): On the Pacific coast the common species of shark is *Squalus sucklei* which is similar in size to the ones Mr. Springer worked with. The fishermen trawled for these sharks. Over a period of years, if they dumped the carcasses in an area they were no longer able to make good catches there and they came to the conclusion that the rotting carcasses were the cause for it. One of the processors who wanted to check this for himself built a pen under his plant, captured some of these dog fish and put them in the pen alive. He threw sharks carcasses in one of the corners of the pen and observed that the sharks would avoid that corner.

Q. Moore: During the latter part of the war shark repellents were provided in airplanes to military personnel on a large scale. It appears from what you said that this was largely for morale, or that there was a misplaced confidence in it.

A. Springer: I didn't mean to imply that this material was of benefit only to morale. As long as a bait was within a cloud of the noxious material the effectiveness (as determined by the number of the bites on controls compared with those on protected bait was 95%. This is about as high as you can get, because some sharks will always approach from the upcurrent direction and will not get in the cloud at all. These feeding inhibitors actually do work, but they are difficult to get around the bait at the time that you want to use them. They are not usually effective against sharks that attack nets, because a net is too large to protect, and can only be protected from one side—the downcurrent side—anyway. I hoped that in presenting this paper I would stimulate a careful long term study of shark repellents.

Q. Menzel: Do you think the repellent has a practical application for protecting the yellowfin tuna?

A. Springer: I don't think it would be practical. The substance costs something on the order of a dollar for enough to protect one bait and you can get an average of only 12 to 15 dollars apiece for the tuna. Also, you don't catch them on every hook.

Q. Galler: Did you work with dyes such as the nigrosine?

A. Springer: Yes we did work with dyes. It happened that at the naval research laboratory, a great deal of work was being done

on the dyes and many dyes were on hand. One of them, a water soluable nigrosine apparently had the same feeding inhibition qualities that the shark meat did. It had the additional advantage of showing what area was protected.

Galtsoff (Comment): This interesting discussion of the paper reminds me that the scientific approach always pays good dividends. I wish to call your attention, for instance, to the recent work of the Canadians who found that salmon show a very definite reaction away from low concentrations of materials derived from natural enemies of the fish.

Problems Concerning the Protection of Shrimp

MILTON J. LINDNER

Q. Osorio: How do you think the commercial shrimp industry will react to your findings?

A. Lindner: I think I tried to explain this morning that you have to decide what you're going after. Make up your mind what you want, and then work it that way. At the moment what you're interested in is, we'll say profits; if you're interested in politics. It depends and fluctuates according to the circumstances.

Q. Llano: Could you elaborate on your statement that the shrimp is its worst enemy?

A. Lindner: My suggestion was that shrimp might be its own worst enemy was based on the 3 waves of spawning success. Spawning is more or less uniform perhaps rising to a peak sometime in June or July, but the success of the spawning comes in waves and seems to be associated with the movement of the shrimp from the nursery grounds into the fishery.

Q. Idyll: This question of the competition among the species is of very fundamental importance. Did you make any reference to data that you may have on competition between the species of shrimp?

A. Lindner: In North Carolina there seems to be a correlation between success of the brown shrimp fishery and failure of white shrimp fishery. This may have happened since 1945 in the northern Gulf of Mexico as the white shrimp have dropped off considerably there while other species are more abundant than formerly.

Q. Idyll: Concerning the rising dominance of the grooved species compared with the white, one suggestion is that there has been a definite change in the population sizes. Another is that the grooved shrimps are more important only because we have discovered how to exploit them. Have you any comment on the two ideas?

A. Lindner: I haven't studied the shrimp since the grooved shrimp fishery became prominent. Undoubtedly, the increased exploitation of the grooved stocks has a great deal to do with it.

FRIDAY—NOVEMBER 19

Chairman—Luis Howell Rivero, *Banco de Fomento Agricola e Industrial de Cuba, Habana, Cuba.*

Fluctuations in the Abundance of Red Snapper *(Lutjanus aya)* On the Campeche Banks* (Abstract)

C. Isaac Camber

The Marine Laboratory, University of Miami, Coral Gables, Florida

A major portion of the United States catch of red snappers originates from the Campeche Banks. The catch consists of several species of which *Lutjanus aya* is the most important one to the fishery. Catches have been reviewed for the period of 1880-1951. Detailed analysis of statistical data on the operations of three fleets have revealed thirty month cycles in the apparent abundance of the fish on the grounds. These are attributed to natural fluctuations in the stocks. The availability of fish on the banks fluctuates seasonally, January and August being the high and low peaks respectively. The general trend in availability of red snappers on Campeche Banks is discussed.

Fluctuaciones en la Abundancia del Pargo Huachinango *(Lutjanus aya)* en los Bancos de Campeche

C. Isaac Camber

The Marine Laboratory, University of Miami, Coral Gables, Florida

Abstracto

La mayoría de la pesca de pargo de los Estados Unidos se origina en los bancos de Campeche. La pesca consiste de varias especies de la cual *Lutjanus aya* es la más importante. Los totales de pescas se han revisado por los años de 1880 a 1951. Un análisis detallado de los datos estadísticos de la operación de tres flotas ha revelado ciclos de 30 meses en la abundancia aparente de los peces en estas regiones. Estas fluctuaciones se han atribuído a fluctuaciones naturales de las poblaciones. La disponibilidad de los peces en los bancos varía de acuerdo con las estaciones, siendo enero y agosto los picos alto y bajo respectivamente.

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El Primer Año de la Pesca del Camarón en Aguas Cubanas

Isabel Perez Farfante

Bióloga Centro de Investigaciones Pesqueras, Banco de Fomento Agrícolo e Industrial de Cuba

En 1953 se descubrió en la porción suroeste de Cuba en el Golfo de Batábano, un banco de camarones. En esta fecha se introdujo en Cuba las redes de arrastre las cuales revolucionaron este sector de la pesca.

El primer barco camaronero que surcó las aguas de Batábano fué el "Ulda Velma", rebantizado en Cuba con el nombre de "Camarón I". En estas primeras pescas se llegó a obtener hasta 2000 libras en una noche. A la terminación del año de 1953 las perspectivas eran tan halagadoras para la industria que varios inversionistas empezaron a adquirir nuevos barcos.

Del 1° de enero al 15 de febrero de 1954 las pescas por barco permanecierno tan altas como antes y en febrero el promedio de pesca por barco fué de 630 libras por noche. A partir del 15 de febrero de 1954 se enforzó una disposición prohibiendo la pesca de camarones. Se descubrió entonces otras regiones de más o menos un area de 10,000 km^2 en las cuales la pesca de camarones era posible.

En mayo de 1954 se autorizó de nuevo la pesca del camarón, pero los barcs ahora nada más que alcanzaron un promedio de 185 libras por noche, habiendo noches en julio en que solo se pescaron 90 libras.

El Centro de Investigaciones pesqueros ha orientado sus estudios hacia el logro de estos dos objetivos: 1. Determinación del efecto de la pesca en las areas de explotación. 2. Estudio de la biología de las dos especies de camarones, *P. duorarum*, y *P. schmitti*. Se han distribuído formas especiales entre los patrones de barcos que operan en Batábano así como otros lugares. También he han empezado ya los estudios biológicos.

Se agradece la asistencia prestado por el Dr. Martin D. Burkenroad.

Another Look At the Caribbean Fisheries

R. T. Whiteleather

Assistant Chief, Branch of Commercial Fisheries Fish and Wildlife Service, Washington, D. C.

A famous American humorist once remarked, "Everybody talks about the weather, but no one does anything about it." Much of the same might be said about the development of the Caribbean fisheries. The local fishermen are ill equipped with vessels and gear for deep sea fishing, and other interests most likely have neglected the area because of the lack of knowledge concerning the fisheries resources in this body of water, although it lies virtually on our door step. While it is true that most of the inshore waters are fished quite extensively for such species of reef fish and pelagic fishes as may be found there, the local fishermen using small craft do not venture far off

shore. It would be accurate to say that practically all of the present production comes from waters within ten miles of the shoreline. These fishermen generally have a good knowledge of the inshore water, but productivity is limited by the character of the fishery resources that are within their reach. Evidence of this is that production in about 20 countries runs in the neighborhood of only 300 million pounds annually, and half of this is Venezuelan production alone, according to FAO statistics. For purpose of comparison, this total for the Caribbean countries is about the same as the amount landed each year in a single United States port, such as San Pedro, California. It is likely, however, that the inshore production cannot be increased very much, except perhaps moderately through the adaptation of a few simple and inexpensive gear improvements.

Now, what about the great mass of water beyond these present limits of exploitation? Hardly anything is known of this area, which exceeds many times that now fished along the shores. Knowing something of the amount of fish in the waters beyond the customary fishing grounds is comparable to keeping good inventory records in a store. It is sound business practice. The fishermen can either make immediate use of this stock, or leave it for harvest when economic conditions and markets are right. In the latter case our fishermen usually say that this is like having money in the bank. Is there money in the bank, so to speak, in the Caribbean through deep-water fishery resources awaiting development?

Almost three years ago at the Caribbean Commission Fisheries Conference in Trinidad, this same question was brought up. There were some indications of the potential value of the Caribbean fisheries, and some fragmentary surveys followed, principally for shrimp and tuna by commercial interests. However, these short lived efforts were reported as not particularly productive, and it is doubtful if much general knowledge has been gained.

Some time has now passed and a few more facts have come to light, so let's have another look at the Caribbean possibilities, at least as far as shrimp and tuna are concerned. Both these species bring a relatively high return to the fisherman, and as a result have been more the subject of speculation as to their availability in the Caribbean than any other species.

From what information we have it appears that the development of a substantial shrimp fishery beyond the immediate coastal waters is the least encouraging of the two prospects. There is no doubt that several species of shrimp occur to some extent over a wide range of coastal waters in the Caribbean. Reports of shrimp taken have confirmed this, but location of sufficient quantities upon which to base a commercial fishery has been the exception rather than the rule. The two most promising types of locations are large bays or lagoons confluent with fresh water rivers, and coastal regions with shelf areas extending some distance outward from the shoreline. Several of the latter areas are found along the east coast of Central America in the vicinity of Honduras and Nicaragua, where some development of the fishery has taken place. The best fishing is reported in the more shallow inshore areas on mud, shell, and sand bottom. Unfortunately the bottom topography of the Caribbean Sea is such that there are relatively few locations of this type, and suitable for trawling. With the exception of ordinary reef areas the bottom generally falls away sharply along most of the island coast lines, and in most places off the mainland shores. The contour drops quickly be-

yond feasible trawling depths, and in those locations where it does not, the bottom is often irregular and is frequently covered with such formidable obstacles as large coral heads or logger-head sponge beds. Even if these disadvantages could be overcome there is little indication of sufficient quantities of shrimp in such areas to make the effort of taking them commercially worth while. Occasionally patches of mud and sand are found interspersed among the coral, but commercial fishing under these circumstances is a costly and exacting enterprise.

As to the estuarine water areas in the larger mainland bays and gulfs, several local fisheries for shrimp have been developed, even though total production is not large in comparison with our Gulf of Mexico grounds. A few of the Caribbean islands embrace large bay areas in their coast lines where shrimp fishing is done commercially. The recent development of the Cuban fishery in the Bay of Batabano is an example of this type of fishery. Bays of this magnitude, however, are not common in most of the other Caribbean islands, which are smaller than Cuba.

To summarize, it would appear that the deeper waters of the Caribbean within customary trawling limits do not hold great promise for extensive shrimp production. In depths beyond this there are practically no clues. Discovery of red shrimp in the Gulf of Mexico by the Fish and Wildlife Service exploratory fishing vessel *Oregon* in depths beyond 1,000 feet is perhaps a remote indicator, but any statement on the promise of this type of fishery in the Caribbean would be the sheerest conjecture at this time.

From the evidence that is accumulating it begins to look more and more like the pelagic fish are the key to any sizeable offshore fisheries development. There already are established tuna fisheries, principally for blackfin tuna in the coastal waters of Cuba and Venezuela, and some canneries for handling these catches. Yet, as to the offshore possibilities there probably is as little basic fishery information on the Caribbean as on any major body of water in the world. What clues have we then with which to work? There are indications from oceanographic studies of the area that basic nutrients are scarce in the Caribbean upper water levels. A vertical profile of the water masses of the Caribbean from north to south shows that the discontinuity layer is sloped upward from about 50 fathoms in depth in the vicinity of Puerto Rico to the surface in the area off the Venezuelan coast. Normally there is practically no transport of the more nutrient rich deeper waters across this very stable layer, except in the upwelling in the region of the northern Venezuelan coast. The nutrient-poor surface thus varies from 0 to 50 fathoms in thickness. Thus, the most reasonable promise for expansion of the offshore fisheries lies in locating pelagic species that live in or move through the Caribbean in the more nutrient-rich subsurface strata. In this respect the tuna and tuna-like fish are of particular interest, as well as other species, such as swordfish, marlin, and sailfish. There is no accurate information about the seasonal movements of these species in the Caribbean. Certain assumptions can be made on the basis of random observations of surface schools by sports fishermen, schooner captains, and others who travel Caribbean waters. From what little is known of the migration of the tuna and tuna-like fishes it is presumed that they follow a general path through the Windward Islands Passages into the Caribbean and later appear off the north coast of Venezuela, the south coast of Cuba, and the Island of Puerto Rico. This fits gen-

erally with the current pattern for the central Caribbean, which is a westerly movement of water from where it enters in the region of the Windward Islands group.

It has been demonstrated during the past year by the catches made by the Fish and Wildlife Service exploratory fishing vessel *Oregon* that yellowfin tuna ranging up to 200 pounds in weight are present over a wide expanse of the Gulf of Mexico at subsurface levels. Some blackfin tuna and bluefin tuna have already been taken on long line gear adapted from the Japanese long line, which can be fished at considerable depths. In the Gulf of Mexico the best long line catches were made in the central Gulf current, which is derived mainly from the Caribbean, flowing strongly through the Yucatan Channel, so that oceanographic conditions in some parts of the two bodies of water may in many ways be quite similar. It is inevitable that this fact should be linked up with other data on the possibility of deep water tuna production in the Caribbean. Also, bluefin, blackfin, yellowfin, and skipjack tuna have all been observed and occasionally taken in the surface waters of the Caribbean, even though they appear very sporadically. Who would say then, that it is inconceivable that larger populations may be located in the deeper waters? During the coming year some exploration of the western Caribbean is included in the schedule for the vessel *Oregon* for the purpose of investigating this theory and for following up on the results of this year's tuna exploration in the Gulf of Mexico. It is not anticipated that the *Oregon* will make complete coverage of the Caribbean offshore reaches; and, in the meantime, some commercial investigation of the long lining potential for tuna and tuna-like fish over a broad area of the Caribbean might pay real dividends when market conditions are right and tuna supplies are in demand. Up until recently there have been no processing facilities, except those mentioned previously, for handling tuna production in the immediate area. A large cannery has now been established in Puerto Rico, and in the event that a sizeable Caribbean tuna production could be demonstrated, there is no reason to believe that commercial interests would not expand, with material benefit to the Caribbean economy.

Another look at the Caribbean seems to justify some optimism, then, with the most hopeful area being the offshore tuna fishery. We are forced still to speculate only, however, until some earnest exploratory and biological work is done.

Otra Vista a las Pesquerías del Caribe

R. T. Whiteleather

U. S. Fish and Wildlife Service, Washington, D. C.

Abstracto

Se han pasado por alto los potenciales pesqueros del mar del Caribe? Las pescas de cerca de la costa confinadas principalmente a pescadores locales están siendo utilizadas. Sin embargo la exploración y desenvolvimiento de las pescas de alta mar son como el clima: todos hablan de él pero nadie hace nada. Los pescadores locales no están equipados para la pesca en alta mar. En general muy poco es sabido acerca de esta gran masa de agua, y la poca in-

formación que se tiene es fragmentaria y basada únicamente sobre observaciones incidentales e inspecciones de corta duración.

Han habido varias conjeturas acerca de la posibilidad de la existencia de peces en aguas profundas del Caribe Central. En la actualidad se cuenta con evidencia que demuestra que peces migratorios como el atún, pez espada, marlin y pez vela, ocurren en cantidades considerables en aguas profundas que no se les ha prestado atención. Un ejemplo es la presencia de cantidades de atunes de aleta amarilla sobre grandes extensiones del Golfo de Méjico, descubiertas por el bajel exploradór Oregon. Las pescas más grandes hechas por el Oregon parecen estar asociadas con la corriente central del Golfo, la cual entra en el golfo con proveniencia del Caribe. Es casi indudable que pescas comerciales de atún ofrecen muy buenas posibilidades en las regiones del Caribe.

DISCUSSION

Caribbean Session

Discussion Leader: F. G. Walton Smith

Discussion Panel: Carlos G. Aguayo, Dudley W. Wiles, Winston Menzel, Jose Suarez

Fluctuations in Abundance of Red Snappers *(Lutjanus aya)* in the Gulf of Mexico

C. Isaac Camber

Q. Howell Rivero: Do you know if any one has tried to fish for snappers around 80 to 130 fathoms with long lines?

A. Camber: I am familiar with attempts to fish with reels at such depths, but not long lines. Deep fishing with reels has proven to be successful and the catches include mainly *Lutjanus vivanus.*

Q. Rivero: Here, I have tried several times to use long lines for deep snapper fishing. I have regular long lines with 100 hooks each working in 80 to 170 fathoms. The average catch of snappers in good condition have been around 30 to 35 for each long line of 100 hooks. Do you think it would be profitable to use this on a commercial basis?

A. Camber: The long line was tried in the red snapper fishery quite a few years ago. One of the drawbacks was the predation by sharks, so the method has been abandoned.

A. Whiteleather: We fished some long lines in the Caribbean during the war and we found great difficulty in working this gear on the type of rough bottom that snappers frequent. A lot of gear was lost and when the amount of gear lost was compared to the amount of fish caught the method did not seem feasible.

Rivero (Comment): I have tried long lines on the north coast of Havana eastward of Cardenas. Gear losses have been light and I feel that long lines should be tried more intensively to see if they would be of commercial value.

Q. Broadhead: You mention the 30 month cycle of highs and lows and also a seasonal drop in catches each summer during the spawning period. Do extremely poor catches result when both the cyclic and the regular seasonal low coincide?

A. Camber: Occasionally. In 1951, the low in the 30 month cycle coincided with the summer low and this resulted in a considerable decrease in yield of fish.

Q. Osorio: Can *Lutjanus aya* from *Lutjanus campechanus* be separated taxonomically?

A. Camber: It is impossible to identify the snappers according to the descriptions in keys offered by Jordan and Evermann. There is no distinction between *L. aya, L. blackfordii* and *L. campechanus.* As Bloch (1797) suggested the original name *L. aya* this should stand until a further revision of the group is done.

Q. Osorio: You are trying to appraise the red snapper fishery on the Campeche Banks according to the landings in Florida and the United States. Fishermen of three countries, U. S., Cuba and Mexico are engaged in the fishery. Mexican landings of red snapper from Campeche can be conservatively estimated about 2,000,000 pounds per year. It would be desirable to know the combined catches for the three countries fishing in this area. How representative of the red snapper fishing fleet is your sample used in the section of your paper on fluctuations in abundance?

A. Camber: As you say, there are three countries involved in the fishery, and I have made a persistent effort to obtain data on the catches by the Cuban and Mexican fleet. I have not been successful in obtaining detailed records. I understand that few Mexican boats are engaged in the offshore fishery for snappers. There are roughly 39 American vessels operating in the Campeche Banks. I analyzed the catches of 28, which represented about 70% of the total American fleet. The records were accurate and meticulously kept by the companies concerned.

Q. Aguayo: Cuban schooners that fish in Campeche catch more grouper than snapper. Is it not the reverse with the American vessels?

A. Camber: That is correct.

Q. Aguayo: How can you explain this situation?

A. Camber: Towards the southern part of the Campeche Banks there seems to be a higher concentration of snappers. I noticed that boats coming from the Arcas region, for instance, come with 95 to 97 percent of the catch snappers. The ratio of snapper to groupers is about 2 to 1 in catches

between Alacran and Arcas. But, if the fishermen operate north of Alacran towards the 100 fathom line, due north of Progresso, the catch is predominantly groupers. As a matter of fact, I saw about 17 or 18 Cuban boats work these grounds consistently for a period of about 2 weeks in 1951.

Q. Wald: Have you attempted to correlate bottom samples with the movement of the fish?

A. Camber: I have tried to use the Bendix Echograms for this purpose and it is obvious that the fish congregate over rocky coral bottom, where there is eel grass. Feeding habits and the direction of the current also influence their movements. The fish may be on one side of the gully during one tide, and on the other side after the tide changes.

Q. Wiles: Have any examinations been made of the stomach contents of red snappers?

A. Camber: I have found that the fish are all carnivorous and their stomach contents included crabs, shrimp and bottom fish. I also found that the small snappers have an exclusive diet of shrimp.

Q. Mowbray: Have you made any attempt to correlate the efforts of the shrimp fleet off Campeche with that of the total catch of red snapper? It appears to me that since shrimp fishing has begun, the catch per unit effort in the snapper fleet has been lower.

A. Camber: The shrimp boats appeared on Campeche in 1951 and catches of red snapper at that time were reduced. Since the snapper catches consist of fish over three years of age I don't think the decrease in catch, if caused by the activity of the shrimp fleet, would be evident until several years after shrimp fishing started.

Q. Wiles: Has there been an increase in catch per unit effort with the introduction of wire lines?

A. Camber: One captain adopted electric reels and wire lines in 1950. His catches, with the same crew, about doubled, possibly due to the shift to deeper waters, made possible by the electric reels and wire lines. The catches of snapper contained a high percentage of *L. vivanus,* the yellow eye snapper.

Smith (Comment): I think that there are a number of interesting things inherent in this paper. The question of young snapper feeding on shrimp brings up some rather interesting questions which may not be entirely theoretical. I remember quite some years ago we drew attention in a report to the fact that the snapper on the west coast of Florida frequently had shrimp in their stomachs, at that time pointed out the possibility of a shrimp fishery along the west coast of Florida as far down as the Dry Tortugas, and as you know, subsequently such an area was discovered. Since, presumably it takes somewhere in the order of 10 times

as much shrimp to make a pound of snapper, it is obviously much better in the long run to catch shrimp than the snapper, but by a strange paradox it may be better to catch the snapper in order that we may catch the shrimp. It might not be wise to restrict fishing for snapper, as any increase in the snapper population might result in reductions of the more valuable shrimp stocks.

The Commercial Species of Penaeidae in Cuban Waters and the Development of the Shrimp Industry in Cuba During its First Year

Isabel Perez Farfante

Q. Lindner: At what depths are the boats now fishing for shrimp in the Cuban fishery?

A. Farfante: Two to 12 fathoms.

Q. Lindner: In May when they started fishing did the boats go into deeper water?

A. Farfante: Not as a rule.

Q. Lindner: There is always the possibility that at that time of the year those species go off shore to spawn and perhaps fishing in deeper waters would be profitable.

A. Farfante: The rocky bottom resulted in a high gear losses and those boats that tried the deeper waters found it uneconomical.

Q. Lindner: Have you been able to establish any correlation between rainfall and shrimp production?

A. Farfante: We have tried, with little success as yet.

Q. Anonymous: Shrimp boat captains operating in the zone of La Broa and Santa Cruz believe that rains affect the production of shrimp. Has anyone investigated this matter or are they contemplating on sending the research vessel *Don Carlos?*

A. Farfante: Yes. We have studied the correlation of rainfall with shrimp production in Cuban waters with little success. For example, last year was a year of high rainfall and this year during the rainy season production was very limited. We have no conclusions, but we are observing the phenomena.

Q. Anonymous: Has the *Don Carlos* conducted any investigations in connection with this matter?

A. Farfante: Not yet, although it is now being considered to send the ship to the area between Santa Cruz and Manzanillo.

Lindner (Comment): Gunter and Hildebrand reported recently on relationship between rainfall and the catch of shrimp two years later. We are finding on the west coast of Mexico, in one area primarily, with *Penaeus,* that a relationship exists between rainfall and catch of shrimp. Rains of June and July, at the beginning of any season, when the rainfall is high, result in high fall catches that year.

Q. Vien: Do you think that temperature could be an important factor in the production of shrimp?

A. Lindner: I have some data ready to be published on that. There is a relation in Buenos Bay between catch and rainfall when the temperature of the air drops below about 20°. Above 20° C. there seems to be no relation between catch and rainfall.

Q. Anonymous: Are there any economic investigations being conducted in connection with attracting foreign capital for the exploitation of our shrimp in the area of Batabano?

A. Farfante: No. I don't think so.

Kahn (Comment): To interest American capital in the shrimp industry of Cuba, one must answer certain basic economic questions. It is to a certain extent astonishing that we do not have the economic data. We have good production records but naturally as an economist, I am interested in prices, costs of transportation, and other economic data. Without this basic information it is difficult, if not impossible to obtain financial assistance in exploitation of the new Cuban shrimp fishery.

Farfante (Comment): Some of the producers have been kind enough to give me their personal data. Officially no records are at present being taken. So, I have obtained from one large dealer and from several owners of small boats the catch record every year since the first year of the shrimp industry in Cuba. We have been unable as yet to establish the official organization to collect data on the shrimp industry.

Canet (Comment): As an officer of the Banco, I would like to make a few comments on this matter of finances. It appears that at present the largest buyer of shrimp in the world, the United States, is going through a crisis in their own shrimp fisheries and it would be inopportune to attempt to attract foreign capital from the United States at this time. Prices in the American market are scarcely covering production costs. The thing to do is to continue with the investigations within the limited funds available to the Centro de Investigaciones Pesqueras and the other sections of the Banco devoted to the development of fisheries. We have on record that in the year following the discovery of our shrimp areas, there was an investment of about $900,000 in ship equipment and other gear in the hope that this would lead to a further development of the fisheries. Unfortunately, reduction in price and of production in Cuba has raised doubts amongst Cuban investors that perhaps the wealth of the shrimp beds has disappeared.

Menzel (Comment): Several years ago the oyster, *Crassostrea virginica*, from the United States was introduced in Cuba, but was not successfully established. This may have been due to the

fungus, *Dermocystiduim marinum,* which according to the research of Dr. Macken, Dr. Ray and others, does it's most damage in temperatures about 20° C. I believe your temperatures are usually above that level. I would suggest before additional work be done on introduction that you investigate the biological aspects carefully.

Farfante (Comment): We have been working on the biology of the *Crassostrea rhizophora* here in order to establish the spawning time and the growth rate of the oyster. We are aiming to find settling strata for the oysters and so far I have tried bamboo and royal palm without any success. Such experiments with drain tile and floor tiles has been successful. The oysters attach in large quantities and grow very well.

Q. Anonymous: I was not in accord with a closed season in the shrimping areas of Cuba. Do you believe that such a system should be changed in future years?

A. Farfante: The point of view was maintained that we were working with a shrimp population of unknown magnitude. Fishing has not been conducted with an intensity that would result in depletion of the grounds.

Q. Anonymous: Wouldn't you think that if we must have a closed season at all that said closed season should be established during the summer months which in the past two years the catch was at a minimum? Do you believe that the Banco is going to discuss a change of such a closed season with the Department of Agriculture?

A. Farfante: Of course more biological work is necessary before we can intelligently regulate the fishery. In the meantime, I think it would be opportune, and as a matter of fact, it is already decided, to prohibit fishing in inland waters, that is waters close to the coast, for the protection of the young.

Survey and Appraisal of Living Aquatic Resources

Kesteven and Osorio-Tafall

Q. Wiles: Do you have your publications printed in English?

A. Osorio: Yes, we have some printed in English.

Q. Kahn: Do you emphasize cooperative movement among fishermen or do you more emphasize individual enterprise?

A. Osorio: We try to emphasize the cooperative movement since we feel that it offers the best protection for the fishermen.

Q. Diez: Has the United Nations an interest in increasing the consumption of fish as a source of protein and if so are they promoting this aspect of the problem?

A. Osorio: FAO is furnishing on request advice on programs to increase the consumption of fish commodities.

Smith (Comment): It seems apparent that in a rather considerable body of water like the Caribbean it would appear that there should be, at least on the surface, a greater fishery production than there is. As Mr. Whiteleather pointed out, there is a very limited extent of shallow water and therefore the production of fish is bound to be limited. On the other hand, and this has been shown by recent developments in the Gulf of Mexico, the pelagic migrants stocks may be more important, and that this is where one should look for a future fishery.

Q. Bottemanne: Have you any data, notion and ideas about the possibilities of a shrimp fishery in the Serinan?

A. Whiteleather: The shrimp possibilities off of the eastern, northeastern coast of South America in the Guiana current and on the broad continental shelf would offer the best promise. In our work around British Guiana we did not catch shrimp in any large quantity, although we didn't spend much time working there.

Q. Wiles: Do you think that there is any relation between the pressing away on the Amazon and Orinoco rivers on the British Guiana and South American coast which will carry food into the current which eventually passes south or north east of Barbados and right through the Caribbean islands?

A. Whiteleather: I'm not an oceanographer, however I don't believe that there is much information on this nutrient material that is carried in to the Caribbean.

Wiles (Comment): We find that there may be a lull in the fishing activities from the dry season on, especially at that dry season as prevails on the British Guiana coast. If British Guiana has a rainfall of 9 to 10 we can look for a productive fishery in the Barbados area. I feel that the large rivers are to some extent carrying food further away from the South American coast and eventually get into the Caribbean area.

Q. Canet: Are there any other fishing grounds for red snapper and grouper in the Caribbean area comparable to that of Campeche?

A. Whiteleather: I don't know of any in the Caribbean. A little south off the continental shelf of British Guiana and Venezuela in the Guiana current there are a reasonably good red snapper grounds now being fished by British Guiana. However, I don't think it has the production potential of Campeche.

Smith (Comment): Some two or three years ago with the excellent assistance of two members of the Cuban Navy, Lt. Brooks and Lt. Franco, I worked out the areas of divergent water mat-

ters in the Gulf of Mexico and found that there was a very considerable area of high divergence on the Campeche Banks and I think that that is where one would look for such a fishery, but there are no similar known areas in the Caribbean. I believe that the most productive areas are in those shallow areas where there is probably considerable river drainage, such as in the Gulf between Trinidad and Venezuela.

Q. Bottemanne: I learned that in Barbados there has been considerable development of the flying fish fisheries. Would you consider the possibility of this fishery being extended to other areas of the Caribbean?

A. Whiteleather: I'll ask Mr. Dudley Wiles to answer this question.

A. Wiles: It has always been my opinion that flying fish in commercial quantities exist up to Florida. I have recently been able to survey the area near the island of Antiga, approximately 600 miles north west of Barbados. We made catches up to 5000 fish with one small boat and I am convinced that at least the ground between Barbados and Antigua would be productive if exploited.

Whiteleather (Comment): I think that Mr. Wiles is correct in suggesting that it is a fishery that needs exploring. In the broad area of the Caribbean we must obtain some of this basic information, otherwise our talk is sheer speculation.

Smith (Comment): I would like to second Dick Whiteleather's plea for more practical exploration, without in any way minimizing the importance of the so-called fundamental studies of biology, oceanography and the sciences related to fisheries. It does seem that the greatest development of fisheries in the future will come if we make use of the already existing knowledge to directing or delimit the operations of exploratory expeditions.

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